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Comparing Defined Contributions to Current Retirement Reform Proposals or Military Retirement

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THESIS

COMPARING DEFINED CONTRIBUTIONS TO CURRENT RETIREMENT REFORM PROPOSALS FOR MILITARY RETIREMENT

by

Brad G. Coleman

June 2013

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In this thesis, an enlisted Sailor's expected net present value (ENPV) was 150% higher with a DC plan than with the OSD options funded at the same level; an officer's ENPV was 115% higher. When considering only the retirees with 20 years of service (YOS), a DC plan generated a net present value 18% higher for enlisted and 13% higher for officers. The DC plan provided a more generous retirement benefit to those who separated before 20 YOS and a slightly better retirement benefit to those who retired after 20 YOS.

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COMPARING DEFINED CONTRIBUTIONS TO CURRENT RETIREMENT REFORM PROPOSALS FOR MILITARY RETIREMENT

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LIST OF ACRONYMS AND ABBREVIATIONS

CEC	Civil Engineer Corps
CNA	Center for Naval Analyses
COLA	Cost of Living Adjustment
CB	Continuation Pay
DB	Defined Benefit
DBB	Defense Business Board
DC	Defined Contribution
DoD	Department of Defense
DoN	Department of the Navy
ENPV	Expected Net Present Value
Hi-3	High Three
LES	Leave and Earnings Statement
NPV	Net Present Value
OSD	Office of the Secretary of Defense
S&P	Standard & Poor's
TIPS	Treasury Inflation-Protected Securities
TP	Transition Payment
TSP	Thrift Savings Plan
YOS	Years of Service

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I. INTRODUCTION

Under pressure to reduce the growth of military spending, the Department of Defense (DoD) has looked at ways to reduce expenditures throughout all budget items, including military retirement. The current system requests a large sum of money each year and sets it aside to fund the defined benefits for retirees 20 years from now. Most proposals follow the same pattern but attempt to significantly reduce costs without severely reducing the retirement benefit to future officers and enlisted communities. The Office of the Secretary of Defense (OSD) has tried to separate from this type of accrual accounting by proposing a hybrid system that decreases the defined benefit (DB) portion and offsets this with two cash payments and a modest defined contribution (DC).

However, none of the proposals have thoroughly examined the effects of the military retirement plan, which is completely DC. The opportunities and risks associated with a DC plan are distinctly different than those offered by the military's DB plans. To date, there has not been a serious analysis of the value associated with a DC retirement plan or a comparison with the most recent proposals.

In this thesis, it is assumed that each OSD proposal was implemented for the cohorts entering the Navy from 1985 to 1992 and calculates the value of these DB-focused retirement proposals. It then assumes that a DC plan was implemented and was funded at the same level as each DB plan for the same cohorts. It then compares the value of the DB proposals with the DC proposals and discusses how it fulfills the goals of reform.

These findings are intended to inform and support decisions regarding military retirement reform. They are also intended to expand the current discussion and encourage additional research into this area that could potentially lead to a leaner retirement system that is still perceived as fair, while allowing the needed flexibility for force shaping.

A. BACKGROUND

Military retirement is a great deal for 13.5% of military members who qualify to receive retirement benefits. After 20 years working in the military, a service member can retire and receive about 50% of their pay for the rest of their life. This fact is one of the

most popular benefits that people cite when they talk about the benefits of military service. However, the cost of retirement benefits is growing primarily because the basic pay of military members has grown at a rate that exceeds the growth of inflation, and the DoD is under pressure to reduce the defense portion of its budget. The most recent proposals under consideration for reforming the military retirement system consider replacing an entirely DB program with a mostly DB program. This move is estimated to save the DoD 10% to 20% of the cost of retirement (Grefer, Phillips, & Shuford, 2012). The DoD has not yet considered the alternative of an entirely DC program that could meet the objectives of retirement reform.

In this chapter, I describe the main features of the current military retirement system and identifies how retirement benefits are calculated and dispersed to the retiree. It then presents how the DoD currently funds the retirement system and examines its shortcomings. The chapter then discusses the main features of DC plans, employees' preference for DC plans, and the call to reform the current system.

B. RETIREE BENEFITS

The belief that military retirement is to receive 50% of your pay for the rest of your life is mostly accurate but requires a little more information to capture the final value. First of all, military retirement is a DB plan, which vests after 20 years of service and pays a lifetime annuity that begins at retirement and is commensurate to your pay upon retirement. These primary points of the retirement system are discussed in detail as follows.

A DB program means that the employee will receive a specific benefit upon retirement. The employer bears the responsibility to select an investment, provide contributions, and manage risks sufficiently to ensure that the benefit is available upon retirement. The employee's primary interest is the size of the benefit upon retirement.

Vesting in a retirement plan means that you own it (Internal Revenue Service, 2013). Civilian DB plans are required to vest using a seven-year graduated vesting or a five-year cliff vesting, as shown in Table 1. Retirement benefits for military retirees cliff vests at 20 years of service (YOS). This means that at 19 YOS, you own 0% of your retirement, and at 20 YOS, you own 100% of your retirement.

Effective Date 1/01/89 - Present- for Defined Benefit Employer Contributions Effective Date 1/01/89 - 2007 - for Other Defined Contribution Employer Contributions Effective Date 1/01/89 - 2002 - 401(k) Matching Employer Contributions	
Graduated Vesting	
years of Service (YOS)	Non-forfeitable Percentage
3	20%
4	40%
5	60%
6	80%
7	100%
Cliff Vesting Less than 5 years of service - 0% Vested At least 5 years of service - 100% Vested	

Table 1. Vestiture Laws for Defined Benefit Retirement Plans (From U.S. Department of Labor, n.d.)

Not only does the retirement benefit vest at 20 years, but payout—when service members can begin to collect retirement benefits—begins upon retirement, which is as early as 20 YOS. These benefits have several features. First, this plan is an annuity that is paid monthly. Second, the amount of the annuity has cost of living adjustments (COLAs) that are designed to compensate for inflation by raising the amount of the annuity by the same percentage of inflation; COLAs occur each year (Under Secretary of Defense, Personnel & Readiness, n.d.). Third, the annuity is paid for the rest of the life of the retiree. And finally, at the death of the retiree, eligible survivors can continue to receive 55% of the inflation-adjusted annuity, unless the retiree elected not to pay the premium for survivor benefits.

The last, primary point of these retirement benefits is the amount or size of the annuity. Current military retirement is purely a function of pay and time in service. It is calculated by multiplying 2.5%, the YOS, and the average of the last three years of pay, which is commonly called "High Three" (Hi-3). Equation 1 shows the calculation for the service member who retires at the end of 20 YOS:

$$Retirement\ Pay = 2.5\% * 20 * \frac{(Pay\ YOS18 + Pay\ YOS19 + Pay\ YOS20)}{3} \quad (1)$$

Twenty multiplied by 2.5% is 50%; this number demonstrates how service members can retire after 20 years and receive half of their pay for life. For an officer who retired as an O5 in 2012, the retirement pay would equal approximately $45,784. Projecting a 5.75% return on investment and retirement pay for 35 years (Grefer et al., 2012), the net present value (NPV) of that annuity is about $690,000. For the enlisted Sailor who retired as an E7, the annuity would be $21,900 per year with the NPV of a 38-year annuity equal to $337,800 (Grefer et al., 2012).

C. GOVERNMENT OBLIGATION AND INVESTMENT

In 1984, Congress required the DoD to use accrual accounting to fund military retirement (Eisenman, Frissmer, Hosek, & Taylor, 2001). The DoD does this by investing a lump sum of money each year and allowing it to grow for 20 years. After 20 years, the money is used to fund retirement benefits for the retirees who joined the military in the year that the lump sum was invested. For example, consider that the retired O5 from the previous section joined the military in 1992. That year, there was an average of 550,847 officers and enlisted Sailors in the Navy (DoN, Military Personnel Navy, 1992, p. 7), of which 47,924 were newly enlisted and 5,087 were newly commissioned (Defense Manpower Data Center, 2013). The Navy calculated the contribution as the product of "Normal cost percentage of … 42.72% in FY92" and "The total amount of basic pay expected to be paid during the fiscal year to members of the armed forces" (DoN, Military Personnel Navy, 1992, p. 24).

Basic pay required for all Sailors was $9.78 billion, and the retirement request was $4.17 billion. The retirement funds then are invested in Treasury Inflation-Protected Securities (TIPS), an investment with minimal risk that provides the modest rate of return of approximately 1% above inflation. In 2012, these funds began to provide retirement benefits for the members of this cohort who retired. However, the average retirement rate for officers is 18% and for enlisted, 13%. In summary, $4.17 billion (41.2% of base pay in 1992) was set aside in 1992 to fund the retirement for an estimated 937 officers and 6,230 enlisted Sailors, which represents 1.3% of the total force in 1992.

D. SHORTCOMINGS OF THE MILITARY RETIREMENT SYSTEM

When the current retirement system is examined with such scrutiny, several shortcomings become apparent. The largest shortcoming from the retiree's perspective is the aspect of transferability to survivors. The two-part problem that the DoD faces is the growth of base pay and the return on the investment. Finally, the problem facing all other service members is that they will leave service before they vest and therefore receive no retirement benefits. The primary focus of retirement reform is to find solutions to the most pressing of these problems.

1. For the Retiree

In light of other problems with the retirement system, increasing survivor benefits receives very little attention. However, it is worth noting because the need exists and other retirement systems address this more effectively. Take for example the retired officer whose life comes to an untimely end shortly after retirement. If this officer was married and had children attending or entering college, the difference between retirement pay and survivor benefits could place college attendance in jeopardy. However, 401(k) retirement plans are fully transferrable to survivors and could provide financial support required by the family. If the retiree truly owns the benefits, then cutting the benefits by 45% acts as an estate tax on his retirement benefits paid by his dependents.

2. For the Department of Defense

Extending full retirement benefits to survivors places greater strain on a system already struggling to meet its liabilities. The DoD faces many challenges in its attempts to manage the spiraling costs of retirement. The first challenge is that pay increases have varied widely over the years and, in some years, have happened twice in a year. This means that budget-makers in 1992 needed to estimate how much pay would increase over the course of a 20-year career, calculate the expected future liability, then calculate the amount of money to request in 1992 that would grow to meet the liability by 2012. This brings us to the second challenge: the contribution has a poor rate of return. While TIPS provide security during times of economic decline, they fail to provide adequate returns in times of

plenty. This low rate of return necessitates a very large investment to meet the future liability of the retirement benefits. The DoD needs to reduce the size of this investment.

3. For Other Military Members

The retirement system is inconsistent with the laws that govern DB plans for the rest of the population. In addition, it helps only a few of the people who serve in the military, which is the problem that all other service members face. Consider the cohort from 1992. The Department of the Navy (DoN) requested $4.17 billion intended to benefit only 13.5% of the cohort, or 1.3% of the force. The other 40% of the cohort who honorably served receive no benefit (Defense Manpower Data Center, 2013). This practice fails to recognize and reward the honorable service and sacrifices made by service members and their families who serve fewer than 20 years. The biggest risk to military members, under the current retirement system, is whether one will receive any retirement benefit. Approximately 86.5% of military members will not receive retirement benefits.

E. DEFINED CONTRIBUTION

A DC retirement plan, on the other hand, is widely used in the civilian workplace and offers many benefits that the current military retirement plan does not provide. DC plans differ primarily from DB plans because the employer is responsible to contribute to an employee's retirement plan and provide plan options from which the employee can choose to invest. The employer has fiduciary responsibility over their DC plans. In other words, the employer can select plans that are in the interest of the plan participants with the "exclusive purpose of providing benefits to them" (U.S. Department of Labor, n.d.). Selecting the choice of plans also allows the employer a degree of control over how much risk the employee will bear.

DC allows employees a degree of freedom, permitting them to take higher or lower risk in an effort to increase returns, security, or diversity. An important benefit of a DC plan is the ability for an employee to transfer their retirement account when they switch employers. When an employer contributes to an employee's plan and allows the employee to manage their retirement investment, it relieves the employer of the responsibility to provide future benefits and eliminates the future liability associated with a DB plan. In

effect, the employer transfers to the employee the responsibility to invest and manage risk to ensure that a benefit exists in the future. Despite this increased risk and responsibility, employees have shown a preference for DC plans over DB plans.

In a comparative examination of DC versus DB retirement plans in the private sector, Childs, Fore, Ott, and Lilly (2012) examined the preference for a DB or DC plan from the point of view of the employer and the employee. The analysis of Childs et al. (2012) suggested that when employees were younger or could easily switch employers, employees and employers preferred DC plans. Employees saw DC contributions as a form of compensation. Employees also valued a DC plan because of its transferability. Employers valued DC plans because they shifted the risk of investment to the employee. In addition, employers who offered DC plans were able to hire at lower salaries than employers who only offered DB plans. Childs et al. also found that the cost of the higher wages dominated any cost savings that DB plans generated through employee retention.

There are several reasons that may explain these results. First, the initial investments of younger individuals can take on more risk. Should taking a greater risk lead to a loss of investment, there is more time to recover from that loss. Second, individuals who are more likely to move will value portability. Third, job turnover is higher for younger employees and employees with less seniority than it is with older, more experienced employees. Finally, employees see DC as a type of compensation, which is interchangeable with salary compensation. The suggestions from Childs et al. (2012), if accurate, may have particular application to the Navy. The employee demographics within the Navy fit within the demographic that prefers DC plans: Approximately 50% of the force is younger than 25 years old and will switch employment after six years. The Navy is interested in reducing costs: A DC plan would shift the risk of investment to employees and may lead to reduced salaries.

F. DISCOUNT RATE

The discount rate is used in financial equations and attempts to quantify the value that an individual places on having money now rather than later. Put very simply, if one is offered $100 next year but has the chance to accept less than $100 now in lieu of payment

next year, the discount rate is the difference between the $100 and today's amount divided by today's amount. For example, if one will accept no less than $90 today in lieu of $100 next year, the discount rate is calculated by Equation 2, which Calculates the discount rate where $100 represents the payment promised in one year and $90 represents the discounted payment accepted at the present time in lieu of future payment (After Brealy, Myers, & Allen, 2011).

Discount Rate (%) = ($100-$90)/$90 = 11.1% (2)

Therefore, one is willing to take 11.1% less money now in lieu of more money in the future. In Childs et al. (2012), a portion of the lower wage that employees would accept from an employer that offered a DC plan represented how the employee valued the transferability of the account. This value could be considered a contributor to a discount rate for a DB retirement plan. In other words, employees will accept lower pay now if given greater control and transferability of the retirement account now. Many of the contributors that influence an individual's preference, or discount rate, for a DC retirement plan are not found in the military's current pension system. Military members might value full transferability to survivors, investment flexibility, payout flexibility, earlier vesting, and the ability to convert military retirement to a second employer's plan.

G. CALL FOR REFORM

The problems faced by the DoD and the service members who receive no retirement benefit motivate the call for reform. Until recently, military retirement reform ignored plans that included DC, relying heavily upon different methods or values of a DB plan. Recently, the OSD proposed modifying the current DB system to a hybrid system composed of DC, DB, and two cash bonuses. The components of these hybrid proposals attempt to address the concerns of affordability for the DoD and provide benefits for military members who serve fewer than 20 years. It should be noted, however, that the DC portion is the only benefit that vests within the first decade of service and is much less valuable than the DB component of these proposals.

This thesis aims to address how a DC retirement system compares to the OSD proposals. The rest of the thesis is organized as follows. Chapter II reviews the most current and relevant studies regarding military retirement reform. Chapter III establishes the methodology used to calculate the values of the retirement systems. Chapter IV discusses the results and findings. Finally, Chapter V summarizes the research and recommends future areas of research.

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II. LITERATURE REVIEW

This chapter reviews the most recent literature related to the topic of this thesis. First is the OSD's five options for retirement reform. Second is the Center for Naval Analyses (CNA) examination of the effects that these proposals will have on the DoN. Third is a Naval Postgraduate School thesis that calculates the probable benefit a Sailor or Marine may expect from these proposals. Finally, a Defense Business Board (DBB) brief recommends moving to a defined contribution system.

A. OFFICE OF THE SECRETARY OF DEFENSE

The OSD had three primary objectives that helped to shape their proposals: first, reduce costs to the DoD; second, have a minimal impact on the current shape of the force; and third, provide some benefit to those who serve fewer than 20 years. The OSD proposed a hybrid benefit that includes two DBs (a second-career benefit and a retirement benefit), a DC, a continuation bonus, and a transition bonus. Each benefit is intended to reduce the cost to the DoD. A tiered DB reduces future liability and the current dollars required to fund it. Career bonuses and transition bonuses are intended to maintain the current force structure by offsetting the reduced future benefit to the retiree by providing a present value. Finally, DCs provide some benefit to those who serve fewer than 20 years.

The OSD created two categories for retirement, one for officers and the other for enlisted. Each category has five different options of the hybrid system. The hybrid system is composed of the following five components: a second-career DB, a retirement benefit, a DC benefit, a continuation bonus, and a transition payment. The difference between the enlisted category and the officer category is the amount of the continuation bonus and the milestone when it is paid.

The second-career DB and the retirement DB are classified as DB1 and DB2, respectively. DB1 acknowledges the likelihood that retirees will seek a second career as a primary source of income; therefore, DB1 would be a supplement to that income. DB1 vests at 20 years and pays benefits until the age of 60. DB2 is considered a full retirement that also vests at 20 years and pays benefits from the age of 60 for life. The DC is a 401(k)-

type benefit that the DoD contributes without requiring additional service member contributions. The DC payments start at YOS 3 and vest at YOS 6. The DoD's DC plan is called the Thrift Savings Plan (TSP). The continuation bonus (CB) is designed to help maintain forces at their current strength, receivable at 12 years of service for enlisted and 16 years of service for officers. The transition payment (TP) is receivable at separation after 20 YOS. In addition to the tiers, there are five options for each tier that are differentiated from each other by the multipliers used to calculate the various benefits. Table 2 shows the options for enlisted retirement, and Table 3 shows the options for officer retirement.

	Option A	Option B	Option C	Option D	Option D.1
DB	0.25*Hi-3	0.16*Hi-3	0.02*YOS*Hi-3	0.015*YOS*Hi-3	0.0175*YOS*Hi-3
DB	0.025*YOS*Hi-3	0.02*YOS*Hi-3	0.02*YOS*Hi-3	0.015*YOS*Hi-3	0.0175*YOS*Hi-3
DC	0.05*BP	0.05*BP	0.05*BP	0.05*BP	0.05*BP
CB	2.49*(1-mo BP)	2.57*(1-mo BP)	2.57*(1-mo BP)	6.65*(1-mo BP)	4.63*(1-mo BP)
TP	2.5*(1-yr BP)	3.0*(1-yr BP)	0.5*(1-yr BP)	1.0*(1-yr BP)	0.75*(1-yr BP)

Table 2. Calculations for OSD Options for Enlisted Retirement (From Grefer et al., 2012)

	Option A	Option B	Option C	Option D	Option D.1
DB1	0.25*Hi-3	0.16*Hi-3	0.02*YOS*Hi-3	0.015*YOS*Hi-3	0.0175*YOS*Hi-3
DB2	0.025*YOS*Hi-3	0.02*YOS*Hi-3	0.02*YOS*Hi-3	0.015*YOS*Hi-3	0.0175*YOS*Hi-3
DC	0.05*BP	0.05*BP	0.05*BP	0.05*BP	0.05*BP
CB	5.78*(1-mo BP)	11.33*(1-mo BP)	8.69*(1-mo BP)	23.53*(1-mo BP)	16.13*(1-mo BP)
TP	2.5*(1-yr BP)	3.0*(1-yr BP)	0.5*(1-yr BP)	1.0*(1-yr BP)	0.75*(1-yr BP)

Table 3. Calculations for OSD Options for Officer Retirement (From Grefer et al., 2012)

When analyzing the multipliers, it is clear that Option A maintains DB2 at the current retirement rate and places higher emphasis on TP. Option B places higher emphasis on CB and TP at the expense of DB1 and DB2. Option C places moderate emphasis on CB and makes DB1 and DB2 the same amount. Option D is similar to Option C except that CB receives the highest emphasis of all options. Finally, Option D.1 provides a middle ground between Option C and Option D. Under all five options, only 15% of the retirement

benefit is from DC, with the majority of retirement benefits (60% to 82%) vesting at 20 years.

B. CENTER FOR NAVAL ANALYSES

As part of a larger analysis in 2012 regarding military retirement reform and its effects on the Navy, Grefer et al. (2012) modeled the OSD's proposals to determine the effects on the Navy's personnel profiles and any cost savings these proposals might generate. Grefer et al. concluded that retirement reform would provide a retirement cost savings to the Navy but at the expense of creating a more junior force. Grefer et al. determined the retirement cost savings by comparing the costs of the proposals to the current retirement contribution costs, 33.4% of base pay for all personnel.

Grefer et al. first calculated the NPV to the retiree of each component of the five options, then added the five components together to determine the total NPV of each option. Next, it calculated the annual contributions required to meet the calculated NPV. Grefer et al. determined that Option A, when fully implemented, would reduce retirement costs by 15.5%, Option B by 20.1%, Option C by 17.1%, Option D by 10.5 %, and Option D.1 by 13.4% (see Table 4).

(in billions of dollars)	Option A	Option B	Option C	Option D	Option D.1
Total Costs of Current System	$3,735.00	$3,735.00	$3,735.00	$3,735.00	$3,735.00
Total Cost of OSD Proposals	$3,157.00	$2,985.00	$3,098.00	$3,344.00	$3,233.00
Total Potential Savings	$578.00	$750.00	$637.00	$391.00	$502.00
% Savings	15.5%	20.1%	17.1%	10.5%	13.4%
New Retirement Contributions	28.23%	26.69%	27.70%	29.90%	28.91%

Table 4. DoN Cost Savings by Implementing Retirement Options

(After Grefer et al., 2012)

In addition to retirement cost savings, Grefer et al. identified a reduction in cost as a result of lower reenlistment rates and fewer people eligible for retirement benefits. Fewer retirees reduces future liability, and lower reenlistment rates requires the Navy to recruit more people so that mid-level jobs can be filled. On the whole, the effect on manning is that some senior personnel, with higher salaries, are replaced by junior personnel, with lower salaries, and the average pay for the DoN is lower.

C. NAVAL POSTGRADUATE SCHOOL

As part of a larger effort in the Naval Postgraduate School's (NPS's) part to look into implementing OSD's recommendations, Chu's (2012) thesis, titled *Military Retirement Reform: An Expected Value Approach*, calculated the NPV of the current system and the OSD options under a variety of discount rates, ranging from 0% to 15%. Chu's (2012) thesis noted that as discount rates increased, so did the relative value of the OSD options with respect to the current system. Chu (2012) noted that the primary cause of this increased value is the weight that earlier payments (DC and CB) played in the calculation. By taking into account a 2.5% preference for earlier payments, we see that the values of the OSD alternatives are higher than the current system. However, this calculation only shows the value of military retirement to the individuals who reach retirement.

Chu's (2012) thesis used expected net present value (ENPV) to determine the value of this new system to the common Sailor. ENPV attempts to quantify the present value of a future amount when the recipient is not 100% certain that they will receive payment. Generally used by companies to plan for uncollected accounts, this calculation helps identify the value of these proposals to the average Sailor, one who is 86% likely to not receive full retirement benefits. Chu's (2012) thesis calculated the ENPV by first calculating the probability of vesting under each component of the options. ENPV shows the benefit that any service member is likely to receive because of a change to the retirement policy. It is interesting to note that if we assume that a cohort of 10,000 people will enlist, with an average discount rate of 7.5%, statistically, 13.5% will receive full retirement. Table 5 compares these values.

(in thousands)	**Option A**	**Option B**	**Option C**	**Option D**	**Option D.1**
NPV	$387.89	$350.10	$354.80	$335.37	$345.21
Total	$523,651.50	$472,635.00	$478,980.00	$452,749.50	$466,033.50
ENPV	$58.44	$52.83	$53.53	$51.74	$52.66
Total	$584,400.00	$528,300.00	$535,300.00	$517,400.00	$526,600.00
Difference	$60,748.50	$55,665.00	$56,320.00	$64,650.50	$60,566.50

Table 5. Total Value of OSD Proposals on a Cohort of 10,000 Recruits (After Chu, 2012)

ENPV does a better job of capturing the benefit that these changes will have on the entire cohort, not just the 13.5% who reach retirement age. It is important to note that earlier payments, made to a greater population, return a significantly higher total value than when the population who receives full retirement is exclusively considered.

ENVP demonstrates the importance of earlier payments when considering retirement benefits. Chu's (2012) thesis noted that the impact of earlier payments on the ENPV calculation is greater for two reasons: first, the effect of the discount rates on later payments and personal preference for earlier payments; second, total attrition is lower early in a career, when these payments vest, and therefore, service members are more likely to receive earlier payments. Chu's (2012) thesis recommended analyzing the effects of a DC retirement system similar to one recommended by the DBB for military retirement.

D. 2011 DEFENSE BUSINESS BOARD BRIEF

In a 2011 brief to the Secretary of Defense, the DBB recommended changing the purely DB retirement system to a purely DC retirement system (Spencer, 2011). Spencer recommended a contribution rate of 16% into a 401(k)-type account. This program would reduce retirement costs by 50%, provide retirement benefits to a larger portion of the military population, and divest the DoD from the future liability of pension plans.

Spencer (2011) proposal suggested several incentives that would increase DC rates for some types of military service. These incentives included combat tours, family separation, and hardship tours. Spencer (2011) noted that the inherent benefits of this type of plan are payout options, partial withdrawals for education or home purchases, and full

transferability of benefits to survivors. Spencer (2011) justified a 16% contribution rate by stating that it is twice as much as the average DC provided in the private sector.

E. SUMMARY

In its retirement reforms, the OSD is ignoring retirement plans that place significant weight on DC. However, Grefer et al. (2012) concluded that retirement reform would lead to a higher proportion of junior personnel. Childs et al. (2012) suggested that employees and employers both prefer DC plans when the employees are middle- to junior-level personnel. And Chu's (2012) thesis demonstrated that plans that offer a DC component provide a greater expectation for retirement benefits to junior personnel. Combined, this information argues that a DC retirement program can provide better compensation for those who detach before 20 years and is preferred by the demographics that make up our military force. This thesis calculates the value of a DC retirement plan and compare the result to the OSD proposals.

III. METHODOLOGY

This chapter provides a detailed explanation of the methodology used in this analysis to calculate and compare the retirement benefits of the OSD proposals and DC retirement plan funded at identical levels. It explains the equations that are used to calculate DC and how these contributions are invested. It also describes how the model values the investment using the number of shares purchased instead of the amount of money invested. It further explains the benefit of "shares accounting" for calculating long-term investments. Finally, it describes how the OSD proposals are calculated for comparison.

DC plans have characteristics that allow the funds to be used before retirement. Funds can be borrowed from the account for current purchases and paid back to avoid early withdrawal penalties. Funds can also be permanently withdrawn and incur tax penalties. DC plans can be transferred to other qualifying plans when employees change employment. They can also be transferred to survivors. The ability to withdraw funds before retirement, whether intended to be permanent or borrowed but never replaced, makes it possible for employees to deplete the funds in the account and unwittingly fall victim to their own poor financial planning.

The characteristics of the OSD proposals provide certain restrictions that manage service members' treatment of the retirement funds. The DC portion vests after five years, which is an incentive to complete the original commitment and provides funds that can be transferred to another qualifying retirement account. The CB is an incentive for middle- to senior-level managers to remain in service. The TP, DB1, and DB2 are incentives to complete 20 years and ensure that retirement benefits exist at retirement.

The DC plan under analysis attempts to match the characteristics of the OSD options, offer similar incentives, and ensure that retirement funds are not depleted by the service member while employed by the DoD. The plan vests upon the honorable completion of the initial commitment. The average length of the first commitment is about six years for enlisted and about four years for officers (Defense Manpower Data Center, 2013). The retirement account cannot be withdrawn during military service, but it can be

rolled over into a private 401(k) upon separation from the military or retirement. The contributions are 100% employer provided, begin when a member begins military service, are a percentage of base pay, and occur at the beginning of each month. Like other traditional 401(k) programs, contributions are pre-tax dollars and the growth is not taxed. In this model, the contributions are used to purchase shares of the Standard & Poor's (S&P) 500 index at market value on the first trading day of the month.

The following sections explain how we capture the values of the various inputs at time *i* and why this equation best represents the value of the account at time *j*, despite the variability of the contributions and the rate of growth of the investment.

A. CONTRIBUTIONS

Base pay changes throughout a 20-year career. Military pay is adjusted between 1%–3% each year for inflation or to compete with civilian pay. Secondly, base pay increases as the YOS of the individual increases. These pay increases occur every other year. Thirdly, base pay increases as rank increases; an O4 is paid more than an O3.

From the Sailor's perspective, annual and biannual increases in pay occur automatically. However, rank advancement is dependent on a community's career path and the typical time in rank for each career. This paper uses the typical civil engineer corps (CEC) officer 20-year career paths and the typical enlisted 20-year career paths for the cohorts under consideration. The typical CEC officer's career followed the approximate time in rank during a 20-year career: two years in O-1, two years in O-2, six years in O-3, five years in O-4, and five years in O-6 (Civil Engineer Corps Detailer & Community Manager, 2012). The typical enlisted Sailor's career followed the approximate time in rank: one year in E-1, one year in E-2, three years in E-3, four years in E-4, six years in E-5, three years in E-6, and one year in E-7 (Defense Manpower Data Center, 2013). These career paths can be found in Appendix A.

This paper analyzes two careers—officer and enlisted—from eight cohorts, 1985 to 1992. It is assumed that each career starts the first day of January and ends the last day of December 20 years later. The career paths are taken and correlated with the monthly

base pay for each career for each cohort. For example, the base pay for an officer from the 1992 cohort during the officer's 11th year is determined by considering the following:

- Officer time in rank: two years in O-1, two years in O-2, six years in O-3, five years in O-4.
- During the 11th year, the officer is an O4.
- The 11th year occurs during 2002.
- From the 2002 pay table, column "over 10," row "O4" shows $4,696.20 to be the officer's base pay (Defense Finance and Accounting Services, n.d).

Determining pay in this manner results in a base pay (BP_i) that takes into account the pay increases associated with inflation, time in service, and rank advancement.

Base pay is then multiplied by the contribution rate (CR%) to calculate the dollar contributions for that month. The contribution rate is based upon the current programmed amount of 33.4% of base pay; from Table 5, we see it discounted by 15.5% for Option A, 20.1% for Option B, 17.1% for Option C, 10.5% for Option D, and 13.4% for Option D.1, in accordance with Grefer et al.'s findings. The discounted percentages used, as a percentage of base pay, are 28.22%, 26.69%, 27.69%, 29.89%, and 28.92% for Options A, B, C, D, and D.1, respectively. Equation 3 shows how the monthly contribution is calculated.

$$Monthly\ Contribution\ = \$BP_i * CR\% \tag{3}$$

Monthly contribution where BP_i is the base pay at time *i* and CR is the percentage from Table 5

B. INVESTMENT VEHICLE

The currency of this retirement fund is the sum of shares purchased throughout the duration of the career. The value of the fund is the product of the total number of shares purchased and the spot price of the shares on that date of valuation.

There are many investment plans that provide investors the ability to customize their investment portfolios to suit their personal tolerance for risk. However, the average of these plans closely resembles the movement of the stock market, and the movement of

the S&P 500 reflects the movement of the market in general. As a result, the contributions are used to purchase shares based upon the value of the S&P 500 index.

The price of the S&P 500 varied significantly from 1984 to 2012. Although the S&P 500 grew 752% from January 1985 to December 2013, there were significant gains and losses throughout that time period. The effects of these gains and losses are poorly represented if the average rate of return or the average annual rate of return is used. Table 7 shows how using averages of a volatile stock price leads to errors in calculations.

Month	Monthly Input	Stock Price	Shares Purchased	Total Shares Purchased	Cumulative Invested	Current Value	Gains (Losses)
1	$100.00	$10.00	10.00	10.00	$100.00	$100.00	$-
2	$100.00	$11.00	9.09	19.09	$200.00	$210.00	$10.00
3	$100.00	$12.00	8.33	27.42	$300.00	$329.09	$29.09
4	$100.00	$13.00	7.69	35.12	$400.00	$456.52	$56.52
5	$100.00	$14.00	7.14	42.26	$500.00	$591.63	$91.63
6	$100.00	$15.00	6.67	48.93	$600.00	$733.89	$133.89
7	$100.00	$15.00	6.67	55.59	$700.00	$833.89	$133.89
8	$100.00	$14.00	7.14	62.74	$800.00	$878.30	$78.30
9	$100.00	$13.00	7.69	70.43	$900.00	$915.56	$15.56
10	$100.00	$12.00	8.33	78.76	$1,000.00	$945.13	$(54.87)
11	$100.00	$11.00	9.09	87.85	$1,100.00	$966.37	$(133.63)
12	$100.00	$10.00	10.00	97.85	$1,200.00	$978.52	$(221.48)
13	$100.00	$10.00	10.00	107.85	$1,300.00	$1,078.52	$(221.48)
14	$100.00	$9.00	11.11	118.96	$1,400.00	$1,070.67	$(329.33)
15	$100.00	$8.00	12.50	131.46	$1,500.00	$1,051.71	$(448.29)
16	$100.00	$7.00	14.29	145.75	$1,600.00	$1,020.24	$(579.76)
17	$100.00	$6.00	16.67	162.42	$1,700.00	$974.49	$(725.51)
18	$100.00	$5.00	20.00	182.42	$1,800.00	$912.08	$(887.92)
19	$100.00	$5.00	20.00	202.42	$1,900.00	$1,012.08	$(887.92)
20	$100.00	$6.00	16.67	219.08	$2,000.00	$1,314.49	$(685.51)
21	$100.00	$7.00	14.29	233.37	$2,100.00	$1,633.58	$(466.42)
22	$100.00	$8.00	12.50	245.87	$2,200.00	$1,966.94	$(233.06)
23	$100.00	$9.00	11.11	256.98	$2,300.00	$2,312.81	$12.81
24	$100.00	$10.00	10.00	266.98	$2,400.00	$2,669.79	$269.79
	Average	$10.00			$2,400.00	$2,669.79	11.2%

Table 6. The Effects of Price Fluctuation on an Account With a Constant Rate of Investment
(After Landry, 2012)

During a 24-month period, the stock price started at $10/share and ended at $10/share, which would imply no growth. The average price was $10/share throughout the 24-month period, which supports the assumption of no growth. One would expect the value

of an account with contributions of $100/month for 24 months in a stock that begins, ends, and has an average price of $10/share will have 240 shares with a total value of $2,400. However, because of price fluctuations, the account had almost 267 shares with an approximate final value of $2,670.

This method of calculating the value of the retirement account better represents the true value of the accounts because it includes the effects that market fluctuation has on an investment. Market fluctuation mitigates the negative effects of market variability on a constant contribution. When the market price rises, fewer shares can be purchased with this contribution. When the price drops, a greater number of shares can be purchased by this contribution. As a result, fewer shares are purchased when the stock is relatively overpriced and more shares are purchased when the stock is at a discount. Calculating the growth of the retirement account thus, we gain a better approximation of the true value of the account. Equation 4 calculates the number of shares purchased each month at time *i*, and Equation 5 calculates the value of the account at time *j*.

$$Shares\ Purchased_i = \frac{\$BP_i * CR\%}{\$Price/share_i} \tag{4}$$

The number of shares purchased at time *i*, where BP_i is the base pay at time *i*, CR is the contribution rate, and $Price/share_i$ is the spot price of the S&P 500 index at the time of contribution *i*

$$Value\ of\ the\ Account_j = \left(\sum_{i=1}^{j} \frac{\$BP_i * CR\%}{\$Price/share_i}\right) * \$Price/share_j \tag{5}$$

The value of the account at time *j*, where BP_i is the base pay at time *i*, CR is the contribution rate, $Price/share_i$ is the spot price of the S&P 500 index at the time of contribution, $Price/share_j$ is the spot price of the S&P 500 index at the time of valuation, and $j \geq i$

C. CALCULATION OF OSD PROPOSALS

To provide an accurate comparison, the OSD options use historical information and invests the contributions similar to the DC plan. The 5% DC, the CB, and the TP multipliers of each option, as shown in Table 2 and Table 3, are multiplied by the appropriate base pay for each career. The DC contributions, the CB, and the TP, when vested, will purchase shares of the S&P 500 index. The value of the DB1 and DB2 will be added at the end of the career but not invested. The NPV of the DB plans will be calculated by Equations 6 and 7.

$$NPV(DB_1) = \frac{A_1}{r} * (1 - \frac{1}{(1+r)^{(\tau_1)}}) \tag{6}$$

Where A_1 is the monthly payment of the annuity DB_1, r is the interest rate of 5.75% used by the DoD (DoD Office of the Actuary [OA], 2012), and t_1 is the duration, in months, that the annuity (A_1) is paid
(From Grefer et al., 2012)

$$NPV(DB_2) = \frac{\frac{A_2}{r} * (1 - \frac{1}{(1+r)^{(\tau_2)}})}{(1+r)^T} \tag{7}$$

Where A_2 is the monthly payment of the annuity DB_2, r is the interest rate of 5.75% used by the DoD (DoD OA, 2012), t_2 is the duration, in months, that the annuity (A_2) is paid, and t_1 is the duration in months between the calculation of the NPV and age 60
(From Grefer et al., 2012)

Equation 6 is used to calculate the NPV of retirement benefits under the current retirement system. The assumptions from the Grefer et al. are used; the average enlisted retirement occurs at age 40, the average officer retirement occurs at age 43, DB_1 is paid until age 60, and the retiree is expected to live to the age of 79.

D. CALCULATING THE VALUE OF THE COHORT

Comparing the value of a DC plan to the entire cohort is accomplished by taking the shares in the individual account at the time of separation and multiplying them by the

number of people who separate. For example, if 100 Sailors from a cohort of 1,000 Sailors, or 10%, will detach during the second year of service, each Sailor was able to accrue 13 shares during the first year but detached before he or she could purchase any shares in the second year. To account for the number of shares purchased by those who detach, the retention rate from the end of the second year is subtracted from the retention rate at the end of the first year. The difference is multiplied by the size of the cohort and the number of shares that each individual purchased during that first year. Equation 8 shows how we account for the total number of detached shares each year.

$$Detached\ Shares = \sum_{i=v}^{20} C * (R_{i-1} - R_i) * Shares\ Purchased_{i-1} \tag{8}$$

Where C is the original size of the cohort, R is the retention rate at time *i*, and *v* is the year when the account vests

An additional challenge to this accounting is caused by vesting. An individual surrenders the account should they separate before their account vests. In this analysis, shares of such an account were sold at the spot price by the OSD and the funds retained for future use. This means that the detached shares did not begin to accumulate until after vesting occurs.

After 20 years, we calculate the value of the retirement proposals to the cohort by multiplying the NPV of the retirement by the number of people who reach 20 years and adding it to the total value of the detached shares. Equation 9 shows how the total value to the cohort is calculated.

$$Value\ to\ the\ Cohort = C * \left(R_j\right) * Value\ of\ Account_j + Detached\ Shares_j \tag{9}$$

Where C is the original size of the cohort, R is the retention rate, and *j* is at 20 years

The retention data for the cohort can be found in Appendix B (Defense Manpower Data Center, 2013).

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IV. RESULTS AND ANALYSIS

This thesis calculated how the Navy's retirement contribution grew under the OSD proposals for the cohorts that entered the Navy from 1985 to 1992. Using the average career path for enlisted and CEC officers, this thesis determines the monthly DC for each option and purchased shares of the S&P 500 index on the first trading day of each month. These shares were recorded and tracked throughout the career. The NPV for each OSD option was calculated and added to the DC investment at the end of the 20-year career. To test for sensitivity, the NPV for each OSD option was calculated using discount rates equal to 5.75% and 12.5% for the entire cohort, 7.0% and 10.0% for the officer cohort, and 8.7% and 12.5% for the enlisted cohort (Grefer et al., 2012). Finally, the CB and the TP were treated under two scenarios, titled "invest" or "spend," with the results added to the NPV.

This thesis also calculated what would have happened if the money used to fund the OSD options were instead used as a DC and given to the Sailors similar to a 401(k) or TSP. The government contributions of this scenario equal the amounts required to fund the OSD options, as determined by the Grefer et al. (2012). These contributions, calculated as a percentage of base pay, correlate to the proposals as follows: current DB at 33.4%, Option A at 28.22%, Option B at 26.69%, Option C at 27.69%, Option D at 29.89%, and Option D.1 at 28.92%. The contributions and purchased shares were calculated in the same manner as the OSD retirement proposals. At the end of the 20-year career, these DC accounts were valued and compared to the current retirement system and the associated OSD proposals.

One challenge faced when calculating the total value of the DB plans is determining what, precisely, should be included in the comparison. The primary focus of the Grefer et al. was to determine the NPV for the retiree. However, the retiree is not the only beneficiary to these proposals. The inclusion of a DC component grants benefits to a larger portion of the cohort, as noted by Chu (2012). To gain a better understanding of the far-reaching effects of these plans, the value for both the retirees and the detached cohort was calculated.

Another challenge faced when comparing the OSD plans to the DC plans stems from two subjective elements: the personal discount rate and a personal inclination to spend

or invest cash bonuses. The first problem was addressed by calculating the NPV using discount rates at rates equal to 5.75% and 12.5% for the entire cohort, 7.0% and 10.0% for the officer cohort, and 8.7% and 12.5% for the enlisted cohort. These rates were used or determined during Grefer et al.'s analysis of the OSD proposals. We address the second problem, the disposition of the bonuses, by analyzing the two extremes; 100% investment and 100% spend, called the "invest" and "spend" scenarios, respectively. In the invest scenario, the CB and TP are used to purchase stocks at the spot price at the time that the cash bonuses are received. In the spend scenario, the CB and TP are not invested and not added to the retirement benefit.

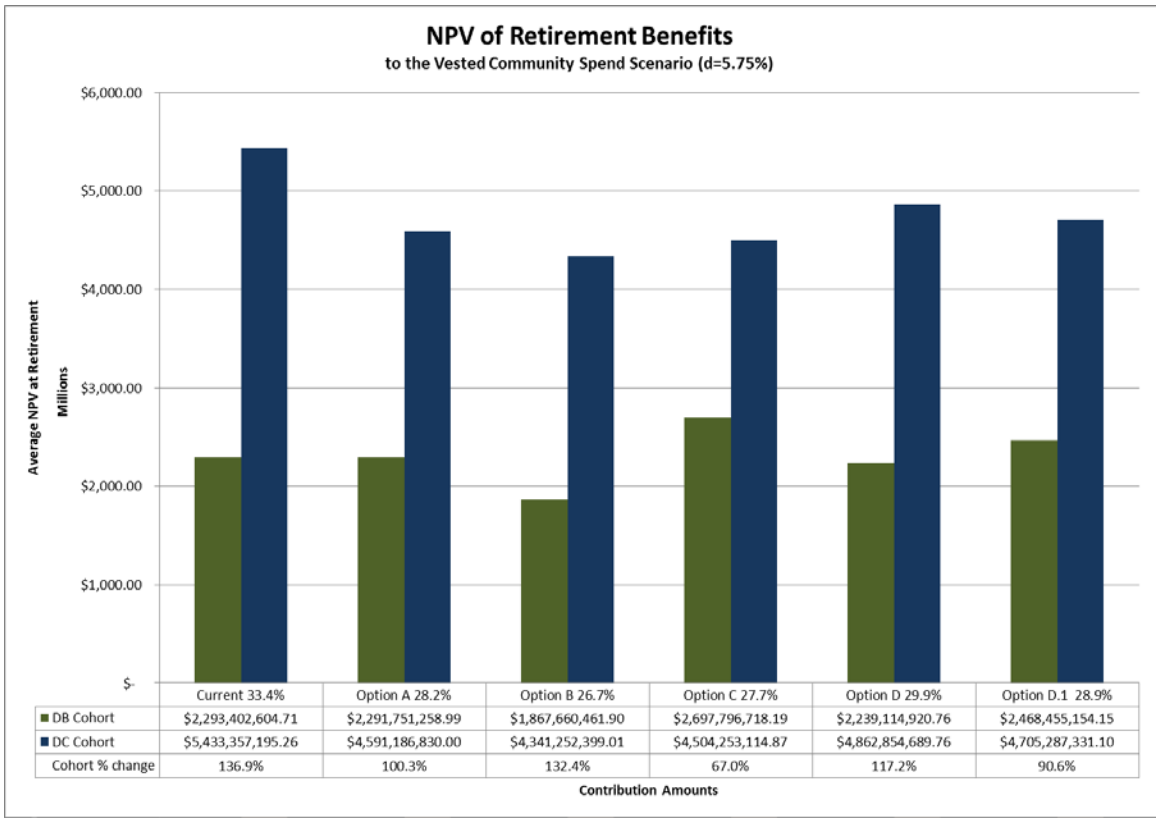
A. OSD INVEST VS. SPEND SCENARIOS

The values of the OSD proposals are highly sensitive to whether the cash bonuses are invested or spent. Investing the bonuses increases the value by a minimum of 10% in Option C and a maximum of 60% in Option B. The OSD proposals in the invest scenario create an illusion of better retirement value as a result of the treatment of the CB and the TP that generates overly idealistic results for two reasons. First, these cash bonuses were not taxed, which would have reduced these amounts by 25%–38%. Second, the after-tax total of the officer bonuses and the enlisted TP exceed the annual limits that restrict individual contributions to an employer-provided retirement plan. At best, the enlisted cohorts would have been able to contribute between $9,000 and $15,000 of their TP instead of the $30,000 to $151,000 calculated by applying Tables 2 and 3. The officer cohorts would have been restricted by the same $9,000 to $15,000 instead of contributing the $32,000 to $287,000 calculated. As a result of these practical and legal restrictions, the invest scenario is unachievable without changing tax laws and 401(k) personal contribution limits. Therefore, the spend scenario is the more practical scenario and is used in the comparisons of this thesis. The charts for the invest scenarios are included in Appendix C.

B. RESULTS

The thesis was able to show that retirement funds invested in a DC system grew larger than the same investments for the current DB system or the OSD's proposed options. Figure 1 shows the total value of the retirement systems to the vested community under the

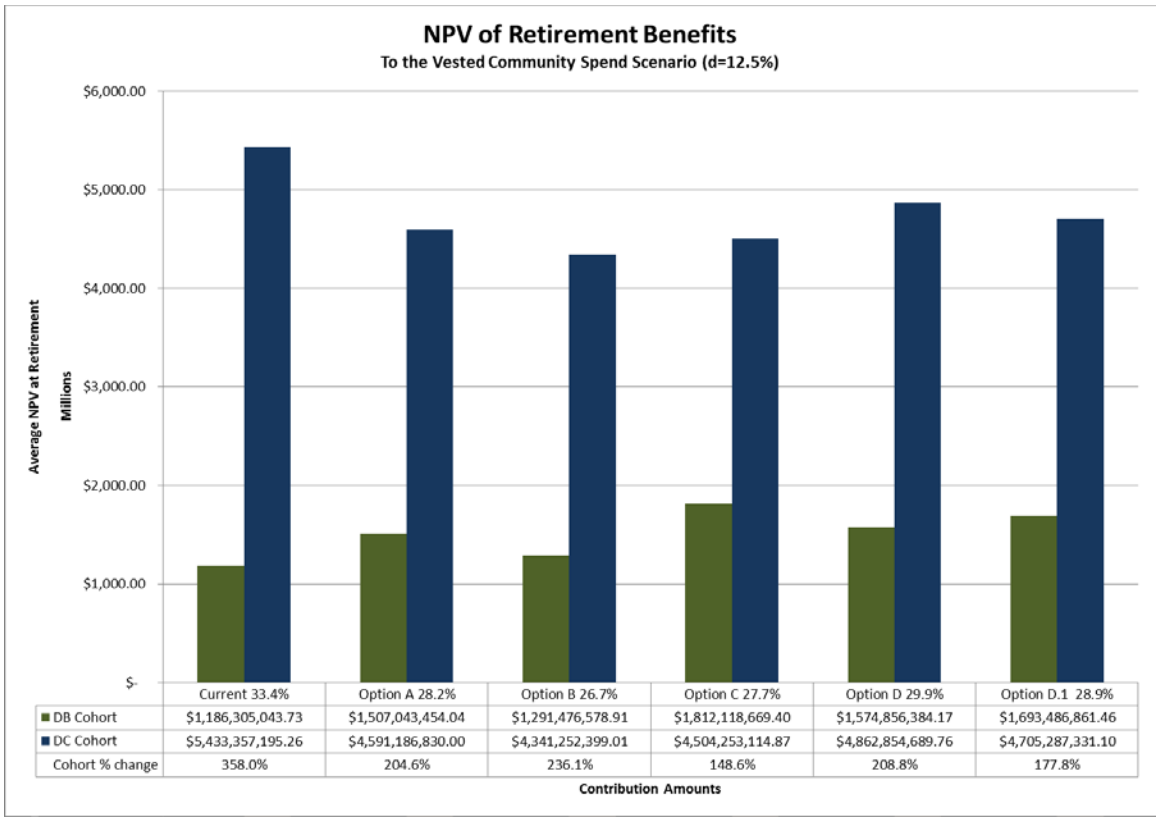
spend scenario at a discount rate of 5.75%. For Figures 1 and 2, the green bars show the growth of the retirement funds if invested in the DB retirement plan of the current and the OSD proposals (both are referred to as DB in the figures). The blue bars show the growth of the retirement funds if invested into the DC plan. The DC plan grew 134% larger than the value of the NPV of the current system and grew 101%, on average, greater than the value of the OSD proposals.



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$2,293,402,604.71	$2,291,751,258.99	$1,867,660,461.90	$2,697,796,718.19	$2,239,114,920.76	$2,468,455,154.15
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	136.9%	100.3%	132.4%	67.0%	117.2%	90.6%

Figure 1. Total Value of Invested Retirement Funds Under the Spend Scenario at a Discount Rate of 5.75%

The values of the OSD proposals are highly sensitive to the discount rate. Figure 2 shows the total value of the retirement systems at a discount rate of 12.5% under the spend scenario. At a discount rate of 12.5%, the DC plan is 358% greater than the current plan and 195% greater, on average, than the OSD options in the spend scenario.

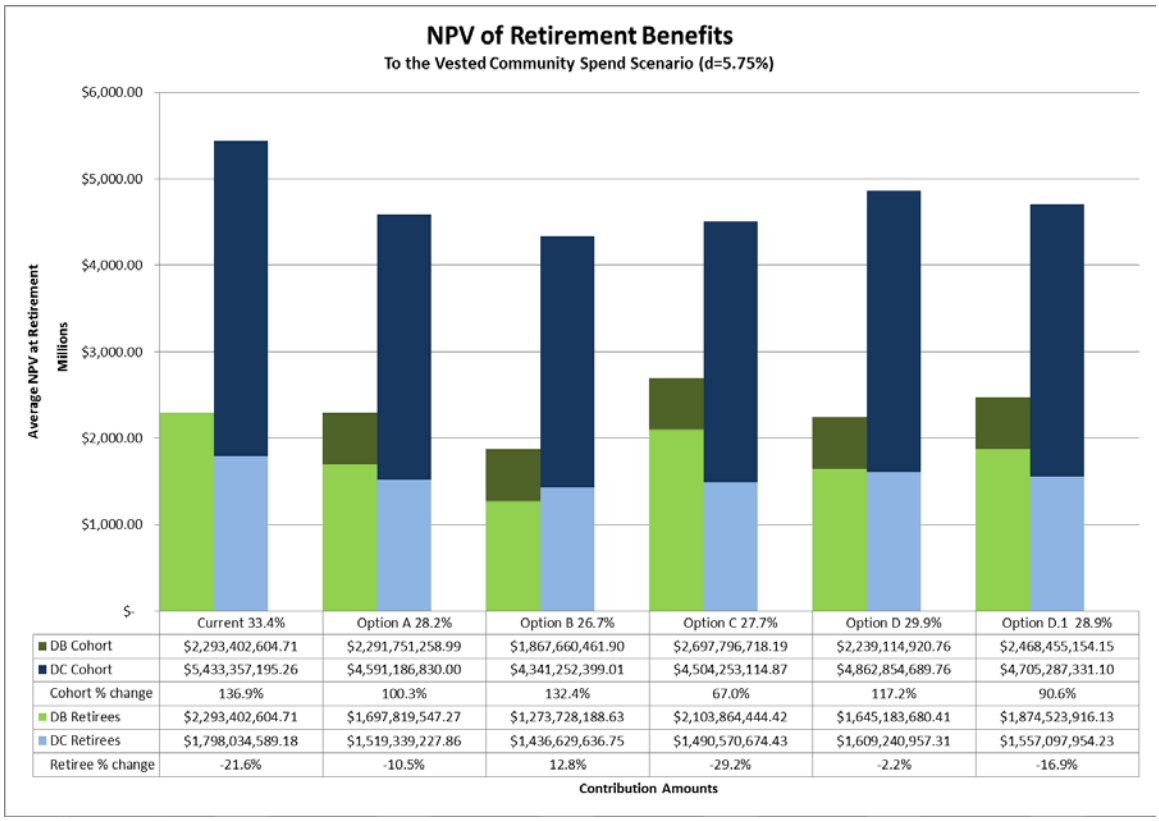


	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$1,186,305,043.73	$1,507,043,454.04	$1,291,476,578.91	$1,812,118,669.40	$1,574,856,384.17	$1,693,486,861.46
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	358.0%	204.6%	236.1%	148.6%	208.8%	177.8%

Figure 2. Total Value of Invested Retirement Funds Under the Spend Scenario at a Discount Rate of 12.5%

1. Benefit to the Retiree (20 Years of Service)

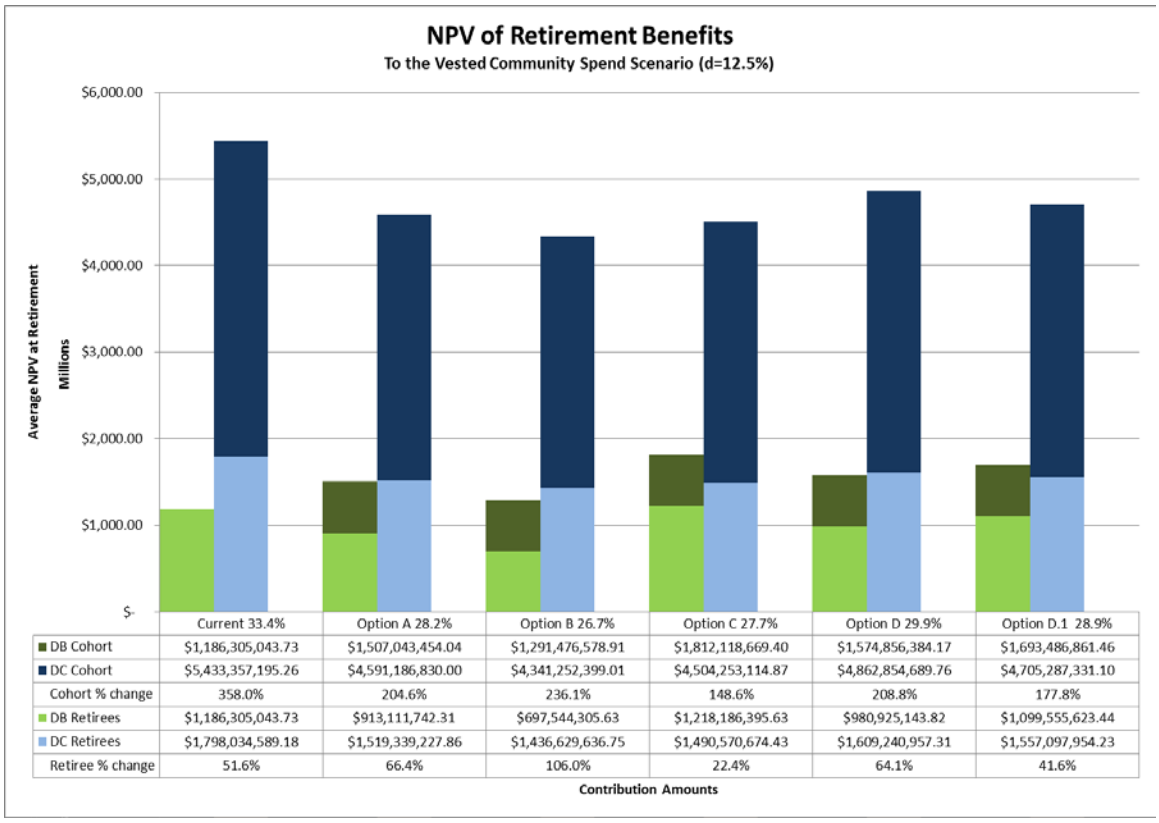
The retirement funds of Figures 1 and 2 are composed of two beneficiaries: those who reach 20 YOS, called “retirees,” and those who vest but detach before 20 YOS. By isolating the retirees, we can identify the retirees’ portion of the DB plans and the DC plan. Taking the retirees’ information and laying it on top of the data for the vested cohort, we can first compare the total value of the DB proposals to the DC plan for the retiree and, second, we can see how much of the retirement benefit is received by those who detached before retirement. Figure 3 shows the retiree’s portion of the retirement proposals for the spend scenario at a discount rate of 5.75%. Like Figures 1 and 2, the blue bars show the value of the DC plan and the green bars show the value of the current DB and the OSD proposals in the spend scenario. The light green and the light blue areas show the portion received by the retirees. Figure 4 shows the same information at a discount rate of 12.5%.



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$2,293,402,604.71	$2,291,751,258.99	$1,867,660,461.90	$2,697,796,718.19	$2,239,114,920.76	$2,468,455,154.15
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	136.9%	100.3%	132.4%	67.0%	117.2%	90.6%
DB Retirees	$2,293,402,604.71	$1,697,819,547.27	$1,273,728,188.63	$2,103,864,444.42	$1,645,183,680.41	$1,874,523,916.13
DC Retirees	$1,798,034,589.18	$1,519,339,227.86	$1,436,629,636.75	$1,490,570,674.43	$1,609,240,957.31	$1,557,097,954.23
Retiree % change	-21.6%	-10.5%	12.8%	-29.2%	-2.2%	-16.9%

Figure 3. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario at a Discount Rate of 5.75%

As we can see, the current system allocates all retirement benefits to those who reach 20 YOS, and the OSD proposals allocate the super-majority of the retirement benefit to those who reach 20 YOS. Under the DC scenario, the retirees' total value is approximately 10% less, on average, than the OSD proposals with a discount rate of 5.75% but 60% greater, on average, with a discount rate of 12.5%. This means that there is a discount rate for which the value of the 20 YOS retirement benefit of the DC scenario is equal, on average, to the OSD scenario. A quick regression analysis gives a discount rate of 6.39%, where the monetary value to the retiree is the same.



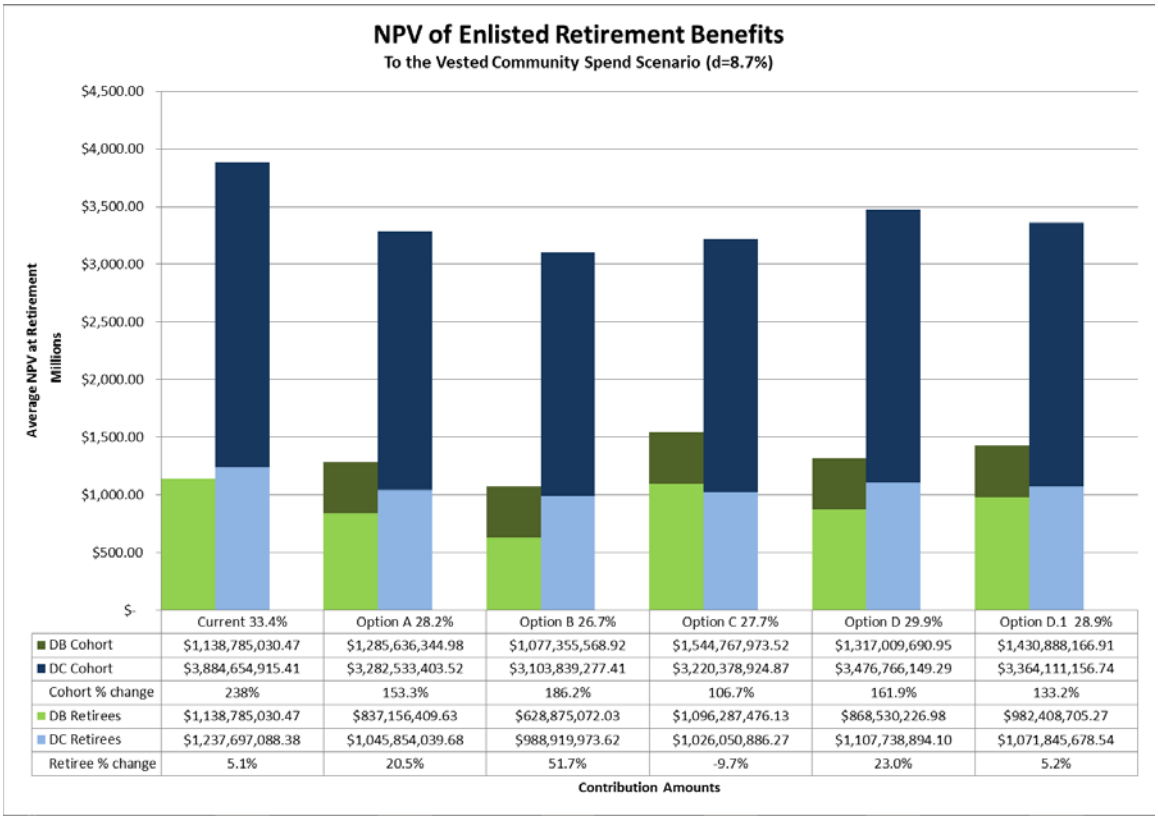
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$1,186,305,043.73	$1,507,043,454.04	$1,291,476,578.91	$1,812,118,669.40	$1,574,856,384.17	$1,693,486,861.46
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	358.0%	204.6%	236.1%	148.6%	208.8%	177.8%
DB Retirees	$1,186,305,043.73	$913,111,742.31	$697,544,305.63	$1,218,186,395.63	$980,925,143.82	$1,099,555,623.44
DC Retirees	$1,798,034,589.18	$1,519,339,227.86	$1,436,629,636.75	$1,490,570,674.43	$1,609,240,957.31	$1,557,097,954.23
Retiree % change	51.6%	66.4%	106.0%	22.4%	64.1%	41.6%

Figure 4. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario at a Discount Rate of 12.5%

A discount rate of 6.39%, however, is outside the spectrum of discount rates that Grefer et al. determined was likely for enlisted (8.7%–12.5%) and officers (7.0%–10.0%). This suggests that both officers and enlisted may prefer a DC plan. For better granularity, the cohort is divided into the enlisted and officer components to compare their respective benefits at their respective discount rates.

2. Enlisted Comparisons

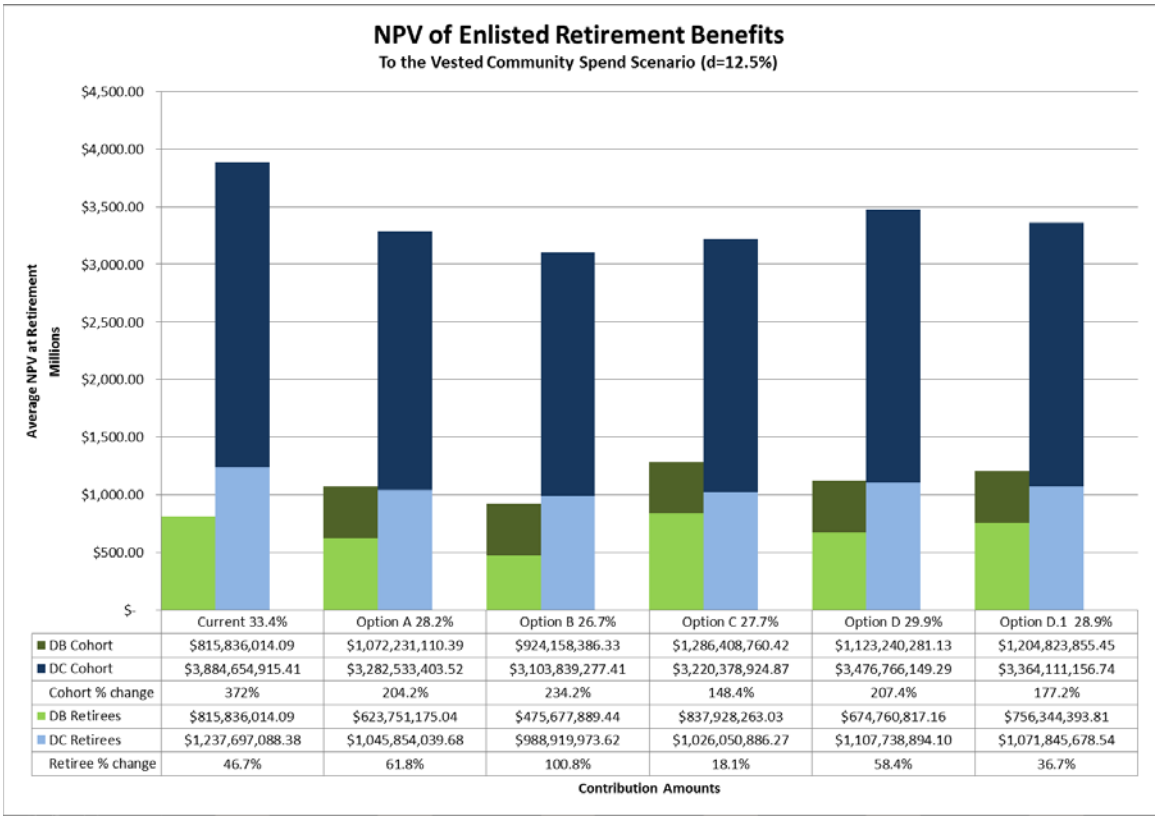
Figures 5 and 6 compare the value of the retirement systems after isolating the enlisted data, which uses the multipliers from Table 2. At a discount rate of 8.7%, Figure 5 shows that the retirement benefit to the vested cohort under the DC system is 238% higher than the current retirement system and 148% higher, on average, than the OSD proposals. It also shows that the retirement benefit for 20 YOS is 18% greater, on average, than the OSD proposals.



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$1,138,785,030.47	$1,285,636,344.98	$1,077,355,568.92	$1,544,767,973.52	$1,317,009,690.95	$1,430,888,166.91
DC Cohort	$3,884,654,915.41	$3,282,533,403.52	$3,103,839,277.41	$3,220,378,924.87	$3,476,766,149.29	$3,364,111,156.74
Cohort % change	238%	153.3%	186.2%	106.7%	161.9%	133.2%
DB Retirees	$1,138,785,030.47	$837,156,409.63	$628,875,072.03	$1,096,287,476.13	$868,530,226.98	$982,408,705.27
DC Retirees	$1,237,697,088.38	$1,045,854,039.68	$988,919,973.62	$1,026,050,886.27	$1,107,738,894.10	$1,071,845,678.54
Retiree % change	5.1%	20.5%	51.7%	-9.7%	23.0%	5.2%

Figure 5. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario for Enlisted Members at a Discount Rate of 8.7%

At a discount rate of 12.5%, Figure 6 shows that the retirement benefit to the vested cohort under the DC system is 372% higher than the current retirement system and 194% higher, on average, than the OSD proposals. It also shows that the retirement benefit for 20 YOS is 55% greater, on average, than the OSD proposals.

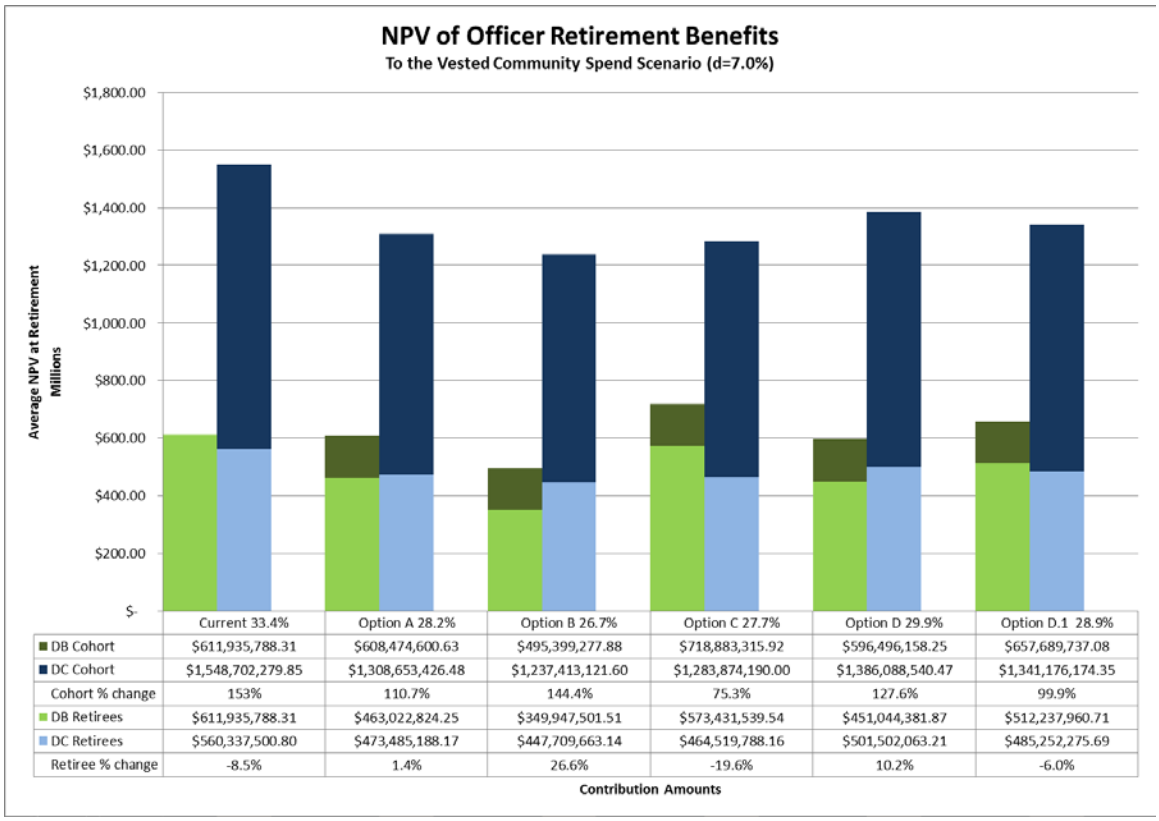


	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$815,836,014.09	$1,072,231,110.39	$924,158,386.33	$1,286,408,760.42	$1,123,240,281.13	$1,204,823,855.45
DC Cohort	$3,884,654,915.41	$3,282,533,403.52	$3,103,839,277.41	$3,220,378,924.87	$3,476,766,149.29	$3,364,111,156.74
Cohort % change	372%	204.2%	234.2%	148.4%	207.4%	177.2%
DB Retirees	$815,836,014.09	$623,751,175.04	$475,677,889.44	$837,928,263.03	$674,760,817.16	$756,344,393.81
DC Retirees	$1,237,697,088.38	$1,045,854,039.68	$988,919,973.62	$1,026,050,886.27	$1,107,738,894.10	$1,071,845,678.54
Retiree % change	46.7%	61.8%	100.8%	18.1%	58.4%	36.7%

Figure 6. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario for Enlisted Members at a Discount Rate of 12.5%

3. Officer Comparisons

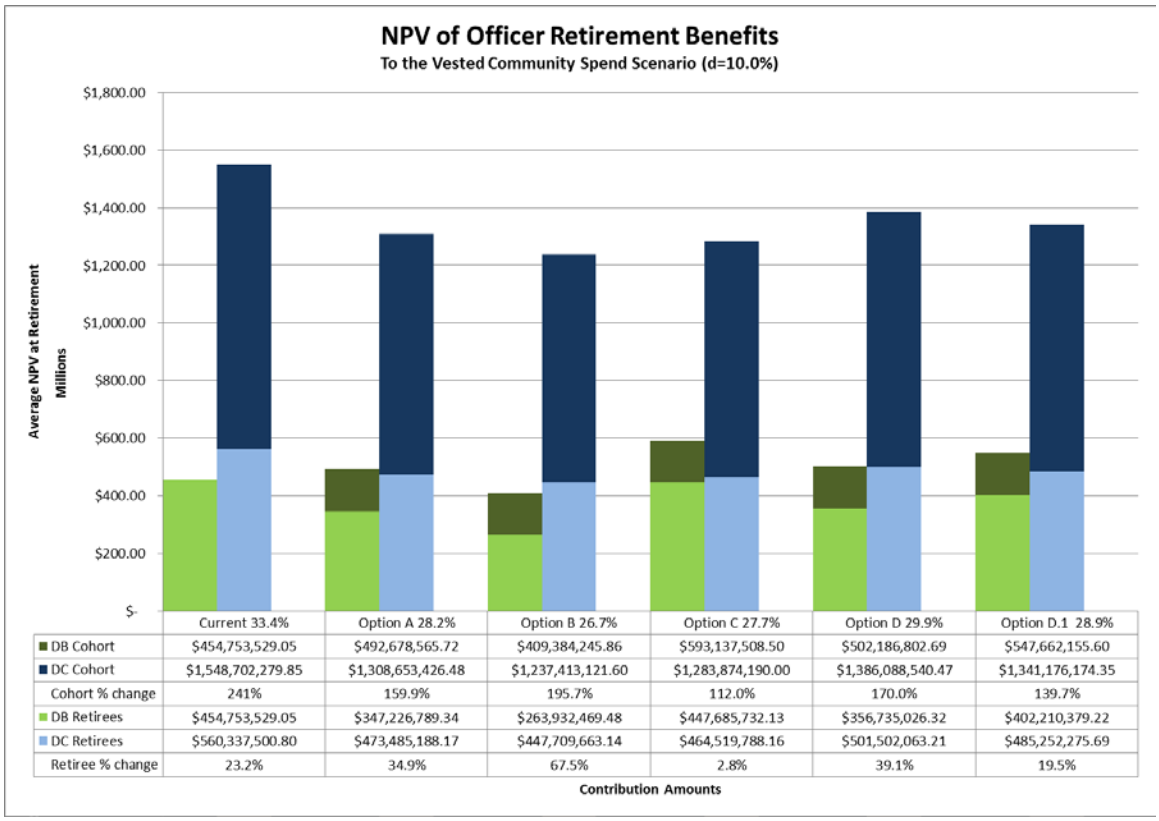
Figures 7 and 8 compare the value of the retirement systems after isolating the officer data, which uses the multipliers from Table 3. At a discount rate of 7.0%, Figure 7 shows that the retirement benefit to the vested cohort under the DC system is 153% higher than the current retirement system and 112% higher, on average, than the OSD proposals. It also shows that the retirement benefit for 20 YOS is 13% greater, on average, than the OSD proposals.



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$611,935,788.31	$608,474,600.63	$495,399,277.88	$718,883,315.92	$596,496,158.25	$657,689,737.08
DC Cohort	$1,548,702,279.85	$1,308,653,426.48	$1,237,413,121.60	$1,283,874,190.00	$1,386,088,540.47	$1,341,176,174.35
Cohort % change	153%	110.7%	144.4%	75.3%	127.6%	99.9%
DB Retirees	$611,935,788.31	$463,022,824.25	$349,947,501.51	$573,431,539.54	$451,044,381.87	$512,237,960.71
DC Retirees	$560,337,500.80	$473,485,188.17	$447,709,663.14	$464,519,788.16	$501,502,063.21	$485,252,275.69
Retiree % change	-8.5%	1.4%	26.6%	-19.6%	10.2%	-6.0%

Figure 7. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario for Officers at a Discount Rate of 7.0%

At a discount rate of 10.0%, Figure 8 shows that the retirement benefit to the vested cohort under the DC system is 241% higher than the current retirement system and 156% higher, on average, than the OSD proposals. It also shows that the retirement benefit for 20 YOS is 33% greater, on average, than the OSD proposals.



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$454,753,529.05	$492,678,565.72	$409,384,245.86	$593,137,508.50	$502,186,802.69	$547,662,155.60
DC Cohort	$1,548,702,279.85	$1,308,653,426.48	$1,237,413,121.60	$1,283,874,190.00	$1,386,088,540.47	$1,341,176,174.35
Cohort % change	241%	159.9%	195.7%	112.0%	170.0%	139.7%
DB Retirees	$454,753,529.05	$347,226,789.34	$263,932,469.48	$447,685,732.13	$356,735,026.32	$402,210,379.22
DC Retirees	$560,337,500.80	$473,485,188.17	$447,709,663.14	$464,519,788.16	$501,502,063.21	$485,252,275.69
Retiree % change	23.2%	34.9%	67.5%	2.8%	39.1%	19.5%

Figure 8. Total Value of the Retired Portion of the Invested Retirement Funds Under the Spend Scenario for Officers at a Discount Rate of 10.0%

C. FINDINGS

1. OSD Sensitivity

Retirement funds grow larger when invested in this DC plan than if they are invested in the current DB or hybrid OSD options. The value of the DC plan to the retiree (someone with at least 20 YOS) is lower than the OSD options when the discount rate is low and becomes higher as the discount rate rises. The values of the DC plans are sensitive to the fluctuation in stock price. The NPVs of the DB for the current and the OSD plans are highly sensitive to the discount rate. In addition, the NPV of the OSD plans are sensitive to the treatment of the cash bonuses.

The values of the OSD proposals are highly sensitive to whether the cash bonuses are invested or spent. The OSD proposals in the investing scenario create an illusion of better retirement value as a result of their treatment of the CB and the TP that generates

overly idealistic results for two reasons. First, these cash bonuses are not taxed, which would have reduced these amounts by 25%–38%. Second, the after-tax total of the officer bonuses and the enlisted TP exceed the annual contribution limits, restricting individual contributions to an employer-provided retirement plan. As a result of these practical and legal restrictions, the invest scenario is unachievable without changing tax laws and 401(k) personal contribution limits.

2. DC Sensitivity

The values of the DC plans are sensitive to the fluctuation in stock price when shares are purchased or sold. The data showed that earlier cohorts were able to purchase more shares during their career because the stock price was low, with respect to the monthly contributions. The price of stocks increased drastically in 1995 and diminished the purchasing power of the monthly contributions. This shift had a greater impact on the later cohorts who were junior enlisted and junior officers during this period. However, when the price of stocks dropped during 2008, these same individuals were able to enhance their holdings because their monthly contributions were much higher than before and the stock prices were much lower than before.

The cohort most vulnerable to stock price retired in 2009. The price of stock began its precipitous rise after the 6th YOS, and it dropped right before retirement. In only three years, however, the stock price recovered. Therefore, the value of the account did not suffer permanent damage unless the shares were sold while the price was low. (See Appendix D.)

The assumptions governing the DC plan for this thesis prohibited withdrawal of retirement funds before separating from the Navy and discouraged withdrawal of funds before retirement. These assumptions enable the Navy a measure of control to ensure that members separate with some benefits. In addition, retirees who reach 20 YOS are permitted to hold, transfer, or withdraw benefits without penalty. This provides retirees a degree of freedom that allows their account to continue to grow, tax free, until they choose to permanently retire. This account, whether withdrawn or allowed to grow, is also fully transferrable to survivors.

3. Vested Cohort

Within the respective discount rates for the enlisted and officer population, investing in a DC system provides at least 2.5 times the benefit to the enlisted population and 2.1 times the benefit to the officer population. The ENPV for the enlisted cohort at the minimum discount rate of 8.7% is shown in Table 7, and the officer cohort at the minimum discount rate of 7.0% is shown in Table 8.

Discount Rate	8.7%					
	Curren 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DC ENPV	$61,85	$52,267.98	$49,422.62	$51,278.29	$55,360.76	$53,566.94
DB ENPV	$18,13	$20,471.26	$17,154.80	$24,597.43	$20,970.82	$22,784.12
	241.1	155.3%	188.1%	108.5%	164.0%	135.1%

Table 7. Enlisted Expected Net Present Value

Discount Rate	7.0%					
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DC ENPV	$246,1	$207,986.88	$196,664.51	$204,048.66	$220,293.79	$213,155.78
DB ENPV	$97,25	$96,706.07	$78,734.79	$114,253.55	$94,802.31	$104,527.93
	153.1%	115.1%	149.8%	78.6%	132.4%	103.9%

Table 8. Officer Expected Net Present Value

Under the assumptions for the DC plan and the assumptions of the OSD plan, enlisted Sailors' ENPV under the DC plan is 150% higher, on average, than the OSD options. The officers' ENPV under the DC plan is 116% higher, on average, than the OSD options. This follows Chu's (2012) conclusions that DCs significantly raise the NPV that a Sailor can expect to receive.

4. Retirees (20 Years of Service)

The OSD proposals reduce the amount of the annuity paid to retirees, under the current system, in exchange for DC contributions and cash bonuses (Grefer et al., 2012). However, only a portion of the bonuses can be set aside for retirement as a result of tax laws and retirement contribution limits. The NPV of the funds that can be used for retirement is less than the NPV of the current retirement benefit. Essentially, the cash bonuses "buy" cooperation instead of providing a practical way to contribute to an individual's retirement plan. In addition, there is a significant risk, greater than 75%, that Sailors will not vest, or receive, the CB, TP, DB_1, and DB_2.

Where the OSD proposals use cash bonuses to incentivize retirees to accept a lower annuity, the DC proposal uses other attributes as incentives. The size of the DC account is proportional to the time in service. The accounts that vest before 20 YOS are much more valuable. In addition, the accounts are fully transferable to survivors and can be either rolled over into another employer's 401(k) plan or left to continue to grow tax free. These incentives come with the opportunity to earn a higher return or risk a significant loss of value.

5. Non-vested Retirement

The DCs in this thesis did not vest until the honorable completion of the first commitment, which averages four years for officer populations and six years for enlisted populations. This resulted in approximately $211 million of retirement funds that were returned to the DoD.

6. Risks of Retirement Plans

The risk associated with the DC plan is directly related to the price of the stock market. Fluctuations in price could cause prices to be high when stocks are purchased and low when members want to sell. This phenomenon was most evident with the 2009 retirees. However, the DC plan provides a foundation whereon the Navy can mitigate these risks. A diverse selection of TSP options allows for members to align the risks of their investment with their personal preference. Commands have financial advisors who can provide information to help members with their decisions. The laws governing TSP accounts provide a degree of control that enables the Navy to protect retirement accounts.

The risk associated with the OSD plan is the likelihood of no vesting in the significant portions of the plan. Less than 17% of the enlisted Sailors and 23% of the officers are eligible to receive CB. Less than 12% of the enlisted Sailors and 18% of the officers are eligible to receive TP, DB_1, and DB_2. The DC portion of the OSD proposal is much smaller than the purely DC account, yet it is vulnerable to the same risks.

D. DISCUSSION

1. Effect on Recruiting

This thesis does not analyze the effect that this system might have on recruiting. While it is likely that most recruits do not attribute military retirement as a significant factor in their decision to join, it does not mean that changes to the retirement program will not have an impact. If DCs are recognized as a form of compensation (Childs et al., 2012), changing from DB to DC, and noting it on the Leave and Earnings Statement (LES), informs the member of the compensation received. This compensation—whether base pay, basic allowance for housing, basic allowance for sustenance, incentive pay, or retirement contributions—may improve potential recruits' impressions of military compensation, increase the number of potential recruits, and improve the quality of recruits.

2. Effects on Retention

This thesis does not analyze the effect that this system might have on retention or shaping the force. If DCs are recognized as compensation, members will be more acutely

aware of the total value of their service. When considering separating from service, military members will be better able to compare and contrast their current pay and benefits with potential offers from civilian employers. It could be that an easily transferable retirement reduces the incentive to stay for 20 years. It is also possible that a DC contribution four to five times the amount typically available from civilian employers would be an incentive to stay in the military.

One way to manage this fluctuation is the judicious use of the non-vested retirement mentioned in Section C.5 of this thesis. During times of high attrition, these funds could be used to provide retention bonuses for critical skills. During times of low attrition, these funds could be used to provide separation bonuses to meet attrition goals. There are many ways that these funds could be used to shape the force without requiring additional appropriations.

3. Effects on the Navy's Budget

This thesis does not analyze the residual effects that a DC retirement system might have on the Navy's budget. The assumptions in the calculations are that each retirement system was operating at a steady state for several decades; therefore, the changes of the retirement systems and their effects on manning or budgets had already occurred. A direct effect on the budget comes from avoiding future liability. The complexities of budgeting for retirement under the current system become increasingly difficult to manage because of the increasing rise of base pay and the addition of COLA. Switching to a DC system can eliminate the future liability of the retirement system and significantly reduce the manpower required to manage and implement retirement benefits. In addition, using a DC retirement system could have an additional effect on the budget. This effect is found in the military members' LES.

The LES shows members their base pay, their allowances, and their incentive pay. The military member looks at the bottom line and sees, what they believe to be, their total compensation. However, this total does not display the medical benefits they receive nor the present value of the potential retirement benefits they might receive if they reach 20 YOS. Under a DC system, the LES could be modified to include the amount of DC received

that month. Assuming that a DC system were approved and funded at 28.3%, the average cost of the OSD proposals, Table 9 shows how the entitlement section of the LES for an O4 stationed at NPS might look before and after such a change. The allotment sections of the LES would then show the DC as an allotment towards the service member's TSP.

Current LES			LES with DC	
Base Pay	6852.90		Base Pay	6852.90
BAS	242.60		BAS	242.60
BAH	3072.00		BAH	3072.00
			DC (28.3%)	1939.37
Total	10167.50		Total	12,106.87

Table 9. Current LES Entitlements Contrasted With an LES That Includes Defined Contribution of 28.3% of Base Pay With the Entitlements

As mentioned in Section D.1, recognizing DC as compensation could entice more recruits to join the military, increase competition for the available slots, and reduce the pressure to raise base pay. These benefits could also lead to increased retention mentioned in Section D.2, thereby reducing the pressure to raise base pay for the subsequent ranks.

E. SUMMARY

This thesis demonstrated that investing in a DC retirement system provides greater retirement benefits to military members than the current system or the OSD proposals, at identical funding levels. In addition, the DC system provides 2.5 times the retirement benefit to enlisted Sailors and 2.1 times the retirement benefit to officers who reach 20 YOS given their respective discount rates. This method allows the Navy to reduce and eventually eliminate its future liability for retirement benefits and provides funds with which to manage force structure through retention or attrition bonuses.

V. CONCLUSIONS AND RECOMMENDATIONS

One way that the DoD is looking to reduce its budgets is by changing the current retirement system. The OSD proposed a system that reduces the DB for members who reach 20 YOS but also includes DCs, which vest earlier, and two cash bonuses to compensate for the lost value. CNA commissioned a study that determined that the OSD options could reduce the Navy's retirement costs by 10%–20% but would also cause lower rates of retention that would require a higher number of recruits to ensure an adequate number of senior personnel.

None of the proposals thoroughly examined the effects of a military retirement plan that is completely DC. The opportunities and risks associated with a DC plan are distinctly different than those offered by the military's DB plans. This thesis calculated how the retirement contributions for each option would have grown for the 1985 to 1992 cohorts had they been in effect. This thesis also calculated how the retirement contributions would have grown under a DC system funded at identical levels. The average of each OSD scenario was compared to the corresponding average of the DC scenario and analyzed.

A. MAIN FINDINGS

Using historical data, this thesis showed that retirement contributions invested under the DC scenario provided twice the retirement benefit to the cohorts than the retirement contributions invested under the OSD proposals. In addition, the DC benefit received by retirees who reach 20 YOS was at least 13% higher, for officers, and 18% higher, for enlisted, than the OSD benefit under the applicable discount rates. The main findings of this research are as follows:

- OSD options are highly sensitive to discount rates and the members' ability to invest the cash bonuses. It is impractical to invest most of the cash bonuses.
- The DC is highly sensitive to the price of stock; high prices can limit the number of shares purchased, and low prices can limit the final value at retirement.
- The ENPV under the DC plan was 150% higher for enlisted and 116% higher for officers than the ENPV under the OSD options.

- Retirees see a slight increase in retirement benefit under the DC system.
  - The trade-off for retirees is between cash bonuses or portability, transferability to survivors, and greater earning potential.
- Non-vested retirement funds returned approximately $211 million to the Navy.
- Service members' greatest risks under the systems are the following:
  - OSD plan: Less than 25% will vest in the CB, TP, and DB components of the system (approximately 90% of the value of the system).
  - DC plan: The member bears the risk of choosing the appropriate plan and the fluctuations of the market.

B. RECOMMENDATIONS

While this thesis demonstrates that a DC retirement plan, receiving equal funding as the OSD options, is a viable option for military retirement, it also leaves many questions unanswered. It suggested that if military members recognize DC contributions as compensation, that could have significant effects on recruiting, retention, and the Navy's budget. Further research should be conducted to determine the impact of a DC retirement plan on the following items:

- military recruiting,
- retention or attrition of service members,
- willingness of new recruits to accept DCs equal to 26% to 33.4% of base pay in lieu of DB retirement,
- transition options and the willingness of existing service members to convert to a DC plan,
- holistic effects on the Navy's budget with regard to pay increases and administration requirements to operate and maintain a DC system, and
- optimal vesting schedule (duration: four, five, six years; type: cliff, graduated).

APPENDIX A: CAREER PATHS

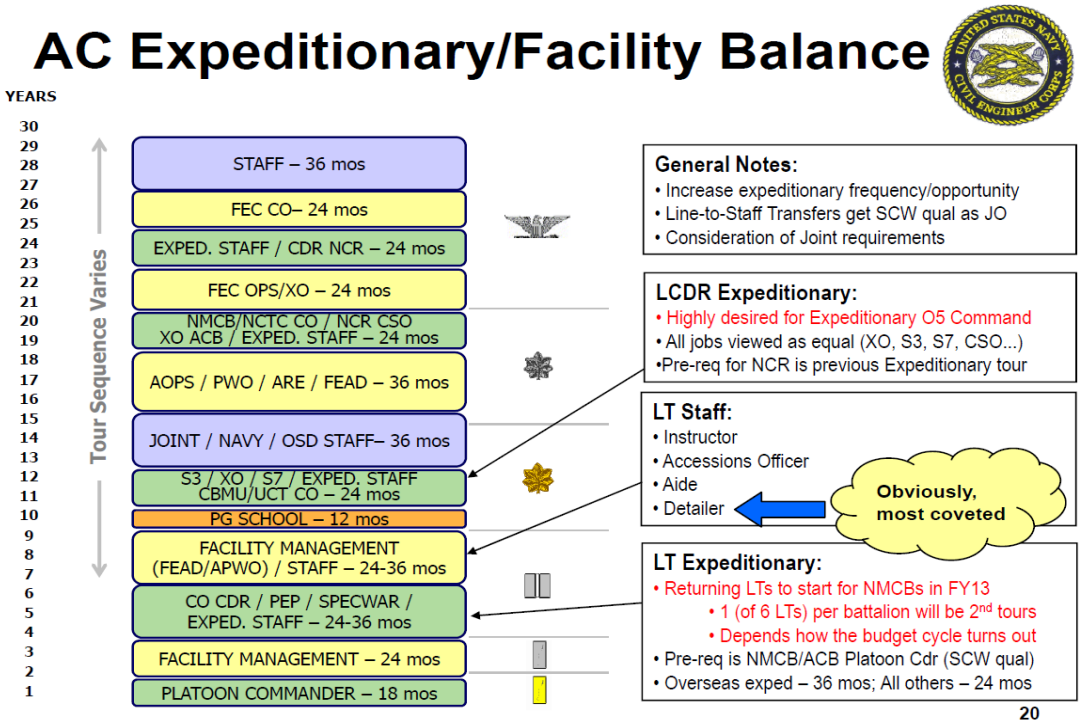


Figure 9. Career Path for Active Duty Civil Engineer Corps Officer

Average Number of Years Served in each Enlisted Rank
for those Individuals who entered the Navy from 1985-1992 and served for 20 or more years

Data as of: January 31, 2013

Source: MEPCOM, MEPCOM Accessions File, WEX Loss File, WEX Current File and Active Duty Master Files

RANK	YEAR OF ACCESSION									
	1985	1986	1987	1988	1989	1990	1991	1992	TOTAL	
E01	0.71	0.75	0.74	0.85	0.85	0.91	0.88	0.84	**0.80**	1.00
E02	1.15	1.10	1.34	1.35	1.42	1.56	1.63	1.51	**1.34**	1.00
E03	2.66	2.64	2.72	2.76	2.85	3.01	3.02	2.82	**2.78**	3.00
E04	4.29	4.37	4.74	4.64	4.79	4.91	4.80	4.73	**4.62**	4.00
E05	6.18	6.23	6.00	5.80	5.65	5.30	5.22	5.23	**5.81**	6.00
E06	4.36	4.24	3.91	4.08	3.87	3.82	3.82	4.19	**4.07**	4.00
E07	1.63	1.63	1.45	1.49	1.08	0.83	0.77	0.67	**1.30**	1.00
E08	0.37	0.34	0.22	0.15	0.12	0.07	0.05	0.05	**0.20**	
E09	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	**0.01**	
									21	**20**

Prepared by Defense Manpower Data Center on April 1, 2013

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Table 10. Career Path for Active Duty Enlisted

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APPENDIX B: RETENTION DATA

Percentage of Officers who Remain on Active Duty from 1 to 20 Years
for those Individuals who entered the Navy from 1985-1992
Source: Officer Cohort File (December 31, 2011), Active Duty Transaction File (February 28, 2013), RCCPDS Transaction File (February 28, 2013), Active Duty Master File (January 31, 2013), RCCPDS (January 31, 2013)

YEAR OF ACCESSION	1985		1986		1987		1988		1989		1990		1991		1992		TOTAL	
	7,485		7,299		6,090		6,284		6,189		6,626		5,279		5,087		50,339	
SURVIVAL TIME	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1 YR	7,375	98.5	7,171	98.2	5,945	97.6	6,124	97.5	6,038	97.6	6,357	95.9	5,092	96.5	4,961	97.5	49,063	97.5
2 YRS	7,300	97.5	7,131	97.7	5,898	96.8	6,060	96.4	5,991	96.8	6,209	93.7	4,992	94.6	4,803	94.4	48,384	96.1
3 YRS	7,205	96.3	6,935	95.0	5,774	94.8	5,958	94.8	5,883	95.1	6,011	90.7	4,820	91.3	4,613	90.7	47,199	93.8
4 YRS	6,956	92.9	6,733	92.2	5,677	93.2	5,839	92.9	5,719	92.4	5,525	83.4	4,368	82.7	4,323	85.0	45,140	89.7
5 YRS	6,332	84.6	6,152	84.3	5,208	85.5	5,290	84.2	5,216	84.3	4,677	70.6	3,846	72.9	3,839	75.5	40,560	80.6
6 YRS	5,524	73.8	5,447	74.6	4,544	74.6	4,599	73.2	4,451	71.9	4,142	62.5	3,412	64.6	3,371	66.3	35,490	70.5
7 YRS	4,888	65.3	4,686	64.2	3,978	65.3	3,977	63.3	3,826	61.8	3,756	56.7	3,070	58.2	3,013	59.2	31,194	62.0
8 YRS	4,367	58.3	4,231	58.0	3,591	59.0	3,503	55.7	3,444	55.6	3,351	50.6	2,693	51.0	2,646	52.0	27,826	55.3
9 YRS	3,843	51.3	3,790	51.9	3,074	50.5	3,040	48.4	3,085	49.8	2,832	42.7	2,325	44.0	2,383	46.8	24,372	48.4
10 YRS	3,281	43.8	3,110	42.6	2,581	42.4	2,627	41.8	2,674	43.2	2,340	35.3	1,986	37.6	2,142	42.1	20,741	41.2
11 YRS	2,840	37.9	2,760	37.8	2,283	37.5	2,287	36.4	2,253	36.4	1,975	29.8	1,749	33.1	1,885	37.1	18,032	35.8
12 YRS	2,563	34.2	2,497	34.2	2,008	33.0	2,011	32.0	1,992	32.2	1,799	27.2	1,594	30.2	1,750	34.4	16,214	32.2
13 YRS	2,162	28.9	2,044	28.0	1,619	26.6	1,693	26.9	1,668	27.0	1,644	24.8	1,490	28.2	1,611	31.7	13,931	27.7
14 YRS	1,924	25.7	1,784	24.4	1,410	23.2	1,506	24.0	1,565	25.3	1,557	23.5	1,388	26.3	1,495	29.4	12,629	25.1
15 YRS	1,796	24.0	1,662	22.8	1,314	21.6	1,424	22.7	1,482	23.9	1,472	22.2	1,304	24.7	1,395	27.4	11,849	23.5
16 YRS	1,682	22.5	1,544	21.2	1,228	20.2	1,343	21.4	1,411	22.8	1,386	20.9	1,242	23.5	1,304	25.6	11,140	22.1
17 YRS	1,589	21.2	1,485	20.3	1,168	19.2	1,269	20.2	1,317	21.3	1,317	19.9	1,150	21.8	1,234	24.3	10,529	20.9
18 YRS	1,531	20.5	1,407	19.3	1,126	18.5	1,201	19.1	1,268	20.5	1,247	18.8	1,115	21.1	1,198	23.6	10,093	20.1
19 YRS	1,495	20.0	1,379	18.9	1,081	17.8	1,151	18.3	1,234	19.9	1,188	17.9	1,076	20.4	1,140	22.4	9,744	19.4
20 YRS	1,448	19.3	1,326	18.2	1,031	16.9	1,103	17.6	1,161	18.8	1,083	16.3	994	18.8	1,042	20.5	9,188	18.3

Prepared by Defense Manpower Data Center on April 18, 2013
DRS #62100

Table 11. Officer Retention for Cohorts From 1985–1992

Percentage of Enlisted Sailors who Remain on Active Duty from 1 to 20 Years
for those Individuals who entered the Navy from 1985-1992
Data as of: January 31, 2013
Source: MEPCOM, MEPCOM Accessions File, WEX Loss File, WEX Current File and Active Duty Master Files

YEAR OF ACCESSION	1985		1986		1987		1988		1989		1990		1991		1992		TOTAL	
	61,717		65,727		60,139		67,999		78,963		68,381		51,562		47,924		502,412	
SURVIVAL TIME	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1 YR	55,299	89.6	58,403	88.9	52,742	87.7	57,868	85.1	68,454	86.7	61,987	90.6	45,229	87.7	40,362	84.2	440,344	87.6
2 YRS	49,404	80.0	51,756	78.7	46,182	76.8	51,291	75.4	61,001	77.3	54,671	80.0	39,721	77.0	35,685	74.5	389,711	77.6
3 YRS	44,766	72.5	46,278	70.4	42,197	70.2	47,749	70.2	55,266	70.0	47,428	69.4	33,407	64.8	31,232	65.2	348,323	69.3
4 YRS	41,035	66.5	42,797	65.1	39,707	66.0	44,424	65.3	48,202	61.0	42,058	61.5	30,352	58.9	28,448	59.4	317,023	63.1
5 YRS	33,987	55.1	35,453	53.9	31,684	52.7	34,435	50.6	38,024	48.2	37,104	54.3	26,158	50.7	24,970	52.1	261,815	52.1
6 YRS	32,263	52.3	33,303	50.7	29,201	48.6	31,967	47.0	35,943	45.5	34,940	51.1	24,246	47.0	23,570	49.2	245,433	48.9
7 YRS	28,615	46.4	30,159	45.9	26,120	43.4	29,812	43.8	33,249	42.1	32,082	46.9	22,874	44.4	21,229	44.3	224,140	44.6
8 YRS	24,233	39.3	26,010	39.6	21,925	36.5	25,428	37.4	28,398	36.0	26,809	39.2	17,628	34.2	14,295	29.8	184,726	36.8
9 YRS	14,847	24.1	14,728	22.4	12,803	21.3	13,730	20.2	12,703	16.1	11,230	16.4	7,377	14.3	6,481	13.5	93,899	18.7
10 YRS	12,985	21.0	12,624	19.2	10,649	17.7	10,801	15.9	10,431	13.2	9,168	13.4	6,060	11.8	5,362	11.2	78,080	15.5
11 YRS	10,956	17.8	10,343	15.7	8,759	14.6	8,726	12.8	8,424	10.7	7,267	10.6	4,943	9.6	4,553	9.5	63,971	12.7
12 YRS	9,904	16.0	9,298	14.1	7,804	13.0	7,790	11.5	7,445	9.4	6,501	9.5	4,448	8.6	4,118	8.6	57,308	11.4
13 YRS	9,229	15.0	8,585	13.1	7,242	12.0	7,177	10.6	6,895	8.7	5,985	8.8	4,122	8.0	3,841	8.0	53,076	10.6
14 YRS	8,628	14.0	8,119	12.4	6,872	11.4	6,788	10.0	6,537	8.3	5,728	8.4	3,893	7.6	3,555	7.4	50,120	10.0
15 YRS	8,244	13.4	7,781	11.8	6,593	11.0	6,522	9.6	6,300	8.0	5,441	8.0	3,713	7.2	3,295	6.9	47,889	9.5
16 YRS	8,017	13.0	7,581	11.5	6,449	10.7	6,372	9.4	6,124	7.8	5,224	7.6	3,551	6.9	3,126	6.5	46,444	9.2
17 YRS	7,874	12.8	7,450	11.3	6,340	10.5	6,223	9.2	5,951	7.5	5,005	7.3	3,410	6.6	3,027	6.3	45,280	9.0
18 YRS	7,759	12.6	7,353	11.2	6,259	10.4	6,121	9.0	5,793	7.3	4,872	7.1	3,343	6.5	2,944	6.1	44,444	8.8
19 YRS	7,702	12.5	7,270	11.1	6,189	10.3	6,025	8.9	5,699	7.2	4,814	7.0	3,283	6.4	2,897	6.0	43,879	8.7
20 YRS	7,629	12.4	7,190	10.9	6,110	10.2	5,932	8.7	5,626	7.1	4,754	7.0	3,247	6.3	2,846	5.9	43,334	8.6

Prepared by Defense Manpower Data Center on March 27, 2013
DRS #62100

Table 12. Enlisted Retention for Cohorts From 1985–1992

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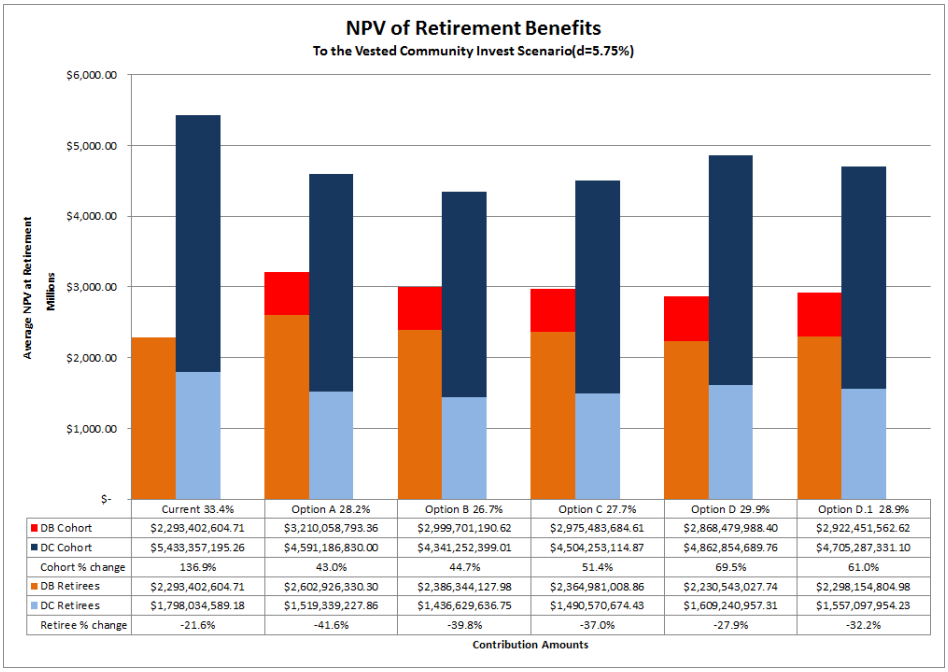
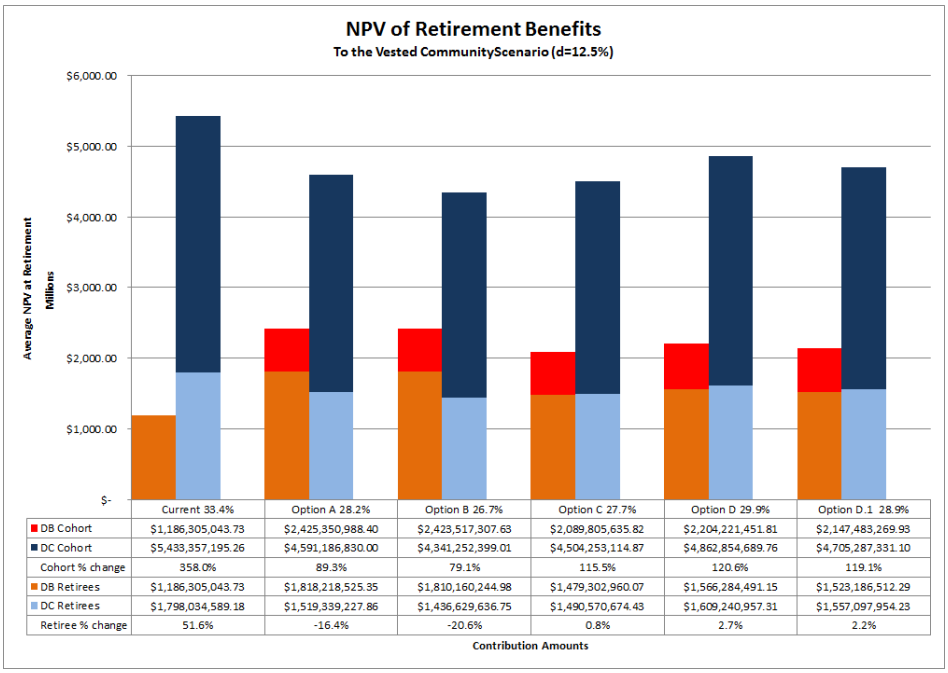
APPENDIX C: INVEST SCENARIO CHARTS



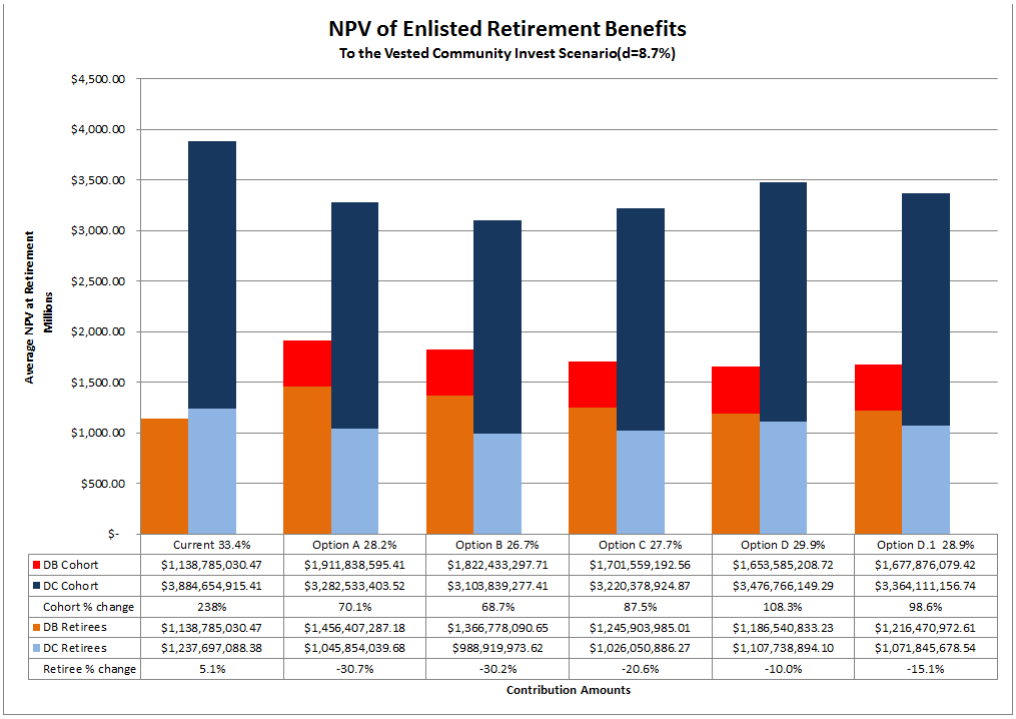
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$2,293,402,604.71	$3,210,058,793.36	$2,999,701,190.62	$2,975,483,684.61	$2,868,479,988.40	$2,922,451,562.62
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	136.9%	43.0%	44.7%	51.4%	69.5%	61.0%
DB Retirees	$2,293,402,604.71	$2,602,926,330.30	$2,386,344,127.98	$2,364,981,008.86	$2,230,543,027.74	$2,298,154,804.98
DC Retirees	$1,798,034,589.18	$1,519,339,227.86	$1,436,629,636.75	$1,490,570,674.43	$1,609,240,957.31	$1,557,097,954.23
Retiree % change	-21.6%	-41.6%	-39.8%	-37.0%	-27.9%	-32.2%

Figure 10. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario at a Discount Rate of 5.75%



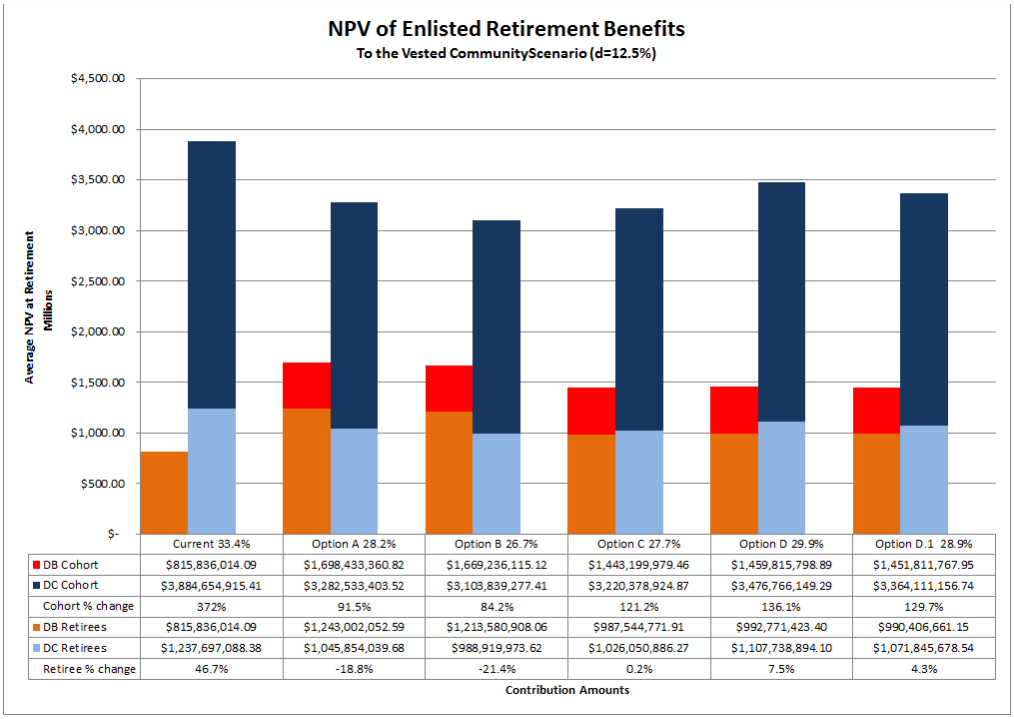
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$1,186,305,043.73	$2,425,350,988.40	$2,423,517,307.63	$2,089,805,635.82	$2,204,221,451.81	$2,147,483,269.93
DC Cohort	$5,433,357,195.26	$4,591,186,830.00	$4,341,252,399.01	$4,504,253,114.87	$4,862,854,689.76	$4,705,287,331.10
Cohort % change	358.0%	89.3%	79.1%	115.5%	120.6%	119.1%
DB Retirees	$1,186,305,043.73	$1,818,218,525.35	$1,810,160,244.98	$1,479,302,960.07	$1,566,284,491.15	$1,523,186,512.29
DC Retirees	$1,798,034,589.18	$1,519,339,227.86	$1,436,629,636.75	$1,490,570,674.43	$1,609,240,957.31	$1,557,097,954.23
Retiree % change	51.6%	-16.4%	-20.6%	0.8%	2.7%	2.2%

Figure 11. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario at a Discount Rate of 12.5%



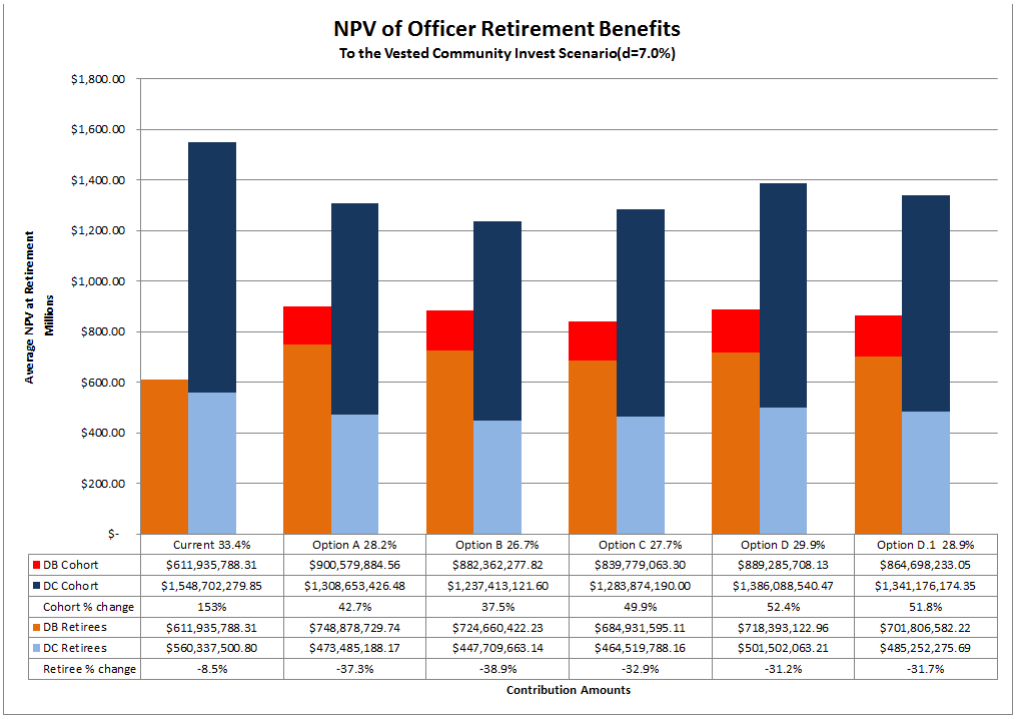
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$1,138,785,030.47	$1,911,838,595.41	$1,822,433,297.71	$1,701,559,192.56	$1,653,585,208.72	$1,677,876,079.42
DC Cohort	$3,884,654,915.41	$3,282,533,403.52	$3,103,839,277.41	$3,220,378,924.87	$3,476,766,149.29	$3,364,111,156.74
Cohort % change	238%	70.1%	68.7%	87.5%	108.3%	98.6%
DB Retirees	$1,138,785,030.47	$1,456,407,287.18	$1,366,778,090.65	$1,245,903,985.01	$1,186,540,833.23	$1,216,470,972.61
DC Retirees	$1,237,697,088.38	$1,045,854,039.68	$988,919,973.62	$1,026,050,886.27	$1,107,738,894.10	$1,071,845,678.54
Retiree % change	5.1%	-30.7%	-30.2%	-20.6%	-10.0%	-15.1%

Figure 12. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario for Enlisted Members at a Discount Rate of 8.7%



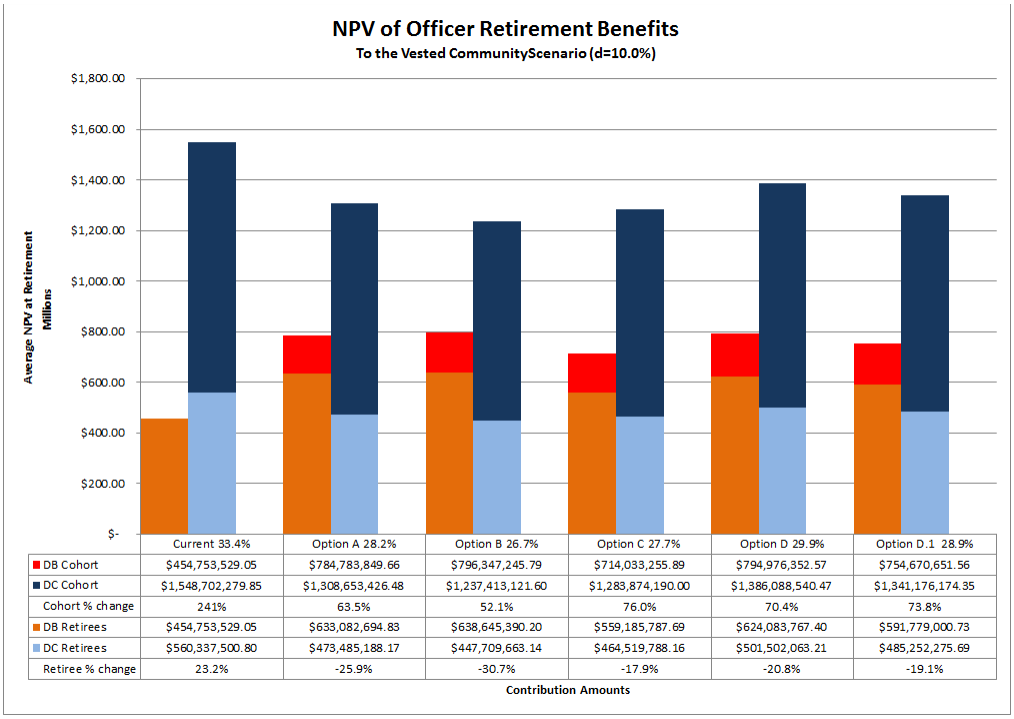
	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$815,836,014.09	$1,698,433,360.82	$1,669,236,115.12	$1,443,199,979.46	$1,459,815,798.89	$1,451,811,767.95
DC Cohort	$3,884,654,915.41	$3,282,533,403.52	$3,103,839,277.41	$3,220,378,924.87	$3,476,766,149.29	$3,364,111,156.74
Cohort % change	372%	91.5%	84.2%	121.2%	136.1%	129.7%
DB Retirees	$815,836,014.09	$1,243,002,052.59	$1,213,580,908.06	$987,544,771.91	$992,771,423.40	$990,406,661.15
DC Retirees	$1,237,697,088.38	$1,045,854,039.68	$988,919,973.62	$1,026,050,886.27	$1,107,738,894.10	$1,071,845,678.54
Retiree % change	46.7%	-18.8%	-21.4%	0.2%	7.5%	4.3%

Figure 13. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario for Enlisted Members at a Discount Rate of 12.5%



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$611,935,788.31	$900,579,884.56	$882,362,277.82	$839,779,063.30	$889,285,708.13	$864,698,233.05
DC Cohort	$1,548,702,279.85	$1,308,653,426.48	$1,237,413,121.60	$1,283,874,190.00	$1,386,088,540.47	$1,341,176,174.35
Cohort % change	153%	42.7%	37.5%	49.9%	52.4%	51.8%
DB Retirees	$611,935,788.31	$748,878,729.74	$724,660,422.23	$684,931,595.11	$718,393,122.96	$701,806,582.22
DC Retirees	$560,337,500.80	$473,485,188.17	$447,709,663.14	$464,519,788.16	$501,502,063.21	$485,252,275.69
Retiree % change	-8.5%	-37.3%	-38.9%	-32.9%	-31.2%	-31.7%

Figure 14. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario for Officers at a Discount Rate of 7.0%



	Current 33.4%	Option A 28.2%	Option B 26.7%	Option C 27.7%	Option D 29.9%	Option D.1 28.9%
DB Cohort	$454,753,529.05	$784,783,849.66	$796,347,245.79	$714,033,255.89	$794,976,352.57	$754,670,651.56
DC Cohort	$1,548,702,279.85	$1,308,653,426.48	$1,237,413,121.60	$1,283,874,190.00	$1,386,088,540.47	$1,341,176,174.35
Cohort % change	241%	63.5%	52.1%	76.0%	70.4%	73.8%
DB Retirees	$454,753,529.05	$633,082,694.83	$638,645,390.20	$559,185,787.69	$624,083,767.40	$591,779,000.73
DC Retirees	$560,337,500.80	$473,485,188.17	$447,709,663.14	$464,519,788.16	$501,502,063.21	$485,252,275.69
Retiree % change	23.2%	-25.9%	-30.7%	-17.9%	-20.8%	-19.1%

Figure 15. Total Value of the Retired Portion of the Invested Retirement Funds Under the Invest Scenario for Officers at a Discount Rate of 10.0%

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APPENDIX D: 2009 RETIREMENT DATA

The charts in this appendix show the growth of a single account throughout a 20-year officer career. At the end of each year (x-axis), the account is represented as a bar. The height of the bar represents the value of the account found on the y-axis. Figures 16 to 21 represents data from the spend scenario of this analysis. The charts show that the value of the defined contribution (DC) account (in red) drops below the value of the Office of the Secretary of Defense (OSD) option at retirement. This drop in value is a result of the drastic drop in the price of the S&P 500 index shares. However, if the funds are not withdrawn from the DC account, the value of the account rises above the value of the OSD option.

The two accounts are treated within the bounds allowed by their respective plans. The DC plan can be withdrawn, transferred, or left alone. The OSD plan requires that the DC component be left alone and the DB component provide a monthly annuity. The annuity changes the spot value of the DB component as time elapses. The reduction in value is accomplished by calculating the net present value (NPV) of the defined benefit (DB) components using months instead of years and recalculating the NPV of the DB components for each month. An incongruity exists in the comparison because the value of the OSD annuity payment is removed from the comparison each month, making the value of the DP component of the OSD account smaller while the DC account is not paying an annuity.

However, this incongruity exemplifies the comparison between these two retirement options. The OSD plan provides the 20-YOS retiree with a more stable source of income and provides some diversification between DC and DB. However, the risk of the OSD plan is that less than 12% of enlisted and 18% of officers will receive these benefits. The DC plan provides the 20-YOS retiree with greater flexibility regarding withdrawal and the ability to transfer and greater opportunity for growth. However, the risk of the DC plan is borne by the retiree and is highly sensitive to stock price. The opportunity for growth with the DC plan is a trade-off for the annuity payment of the OSD option.

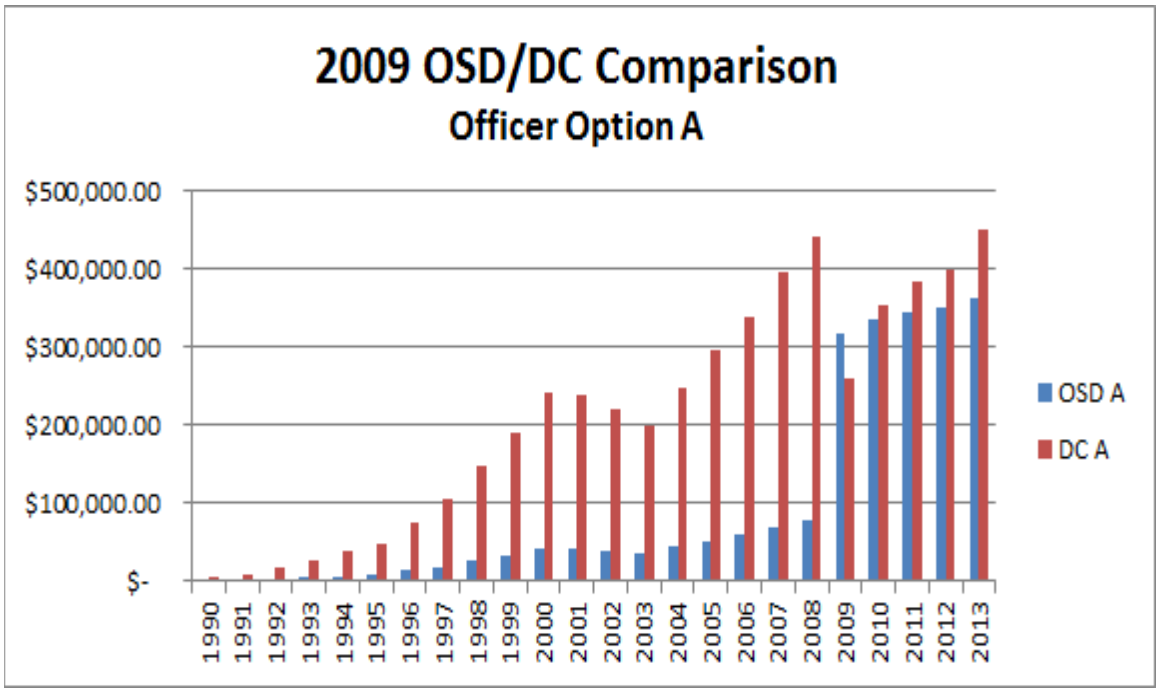

Figure 16. Comparing the Growth of OSD A to DC for 2009 Retirees

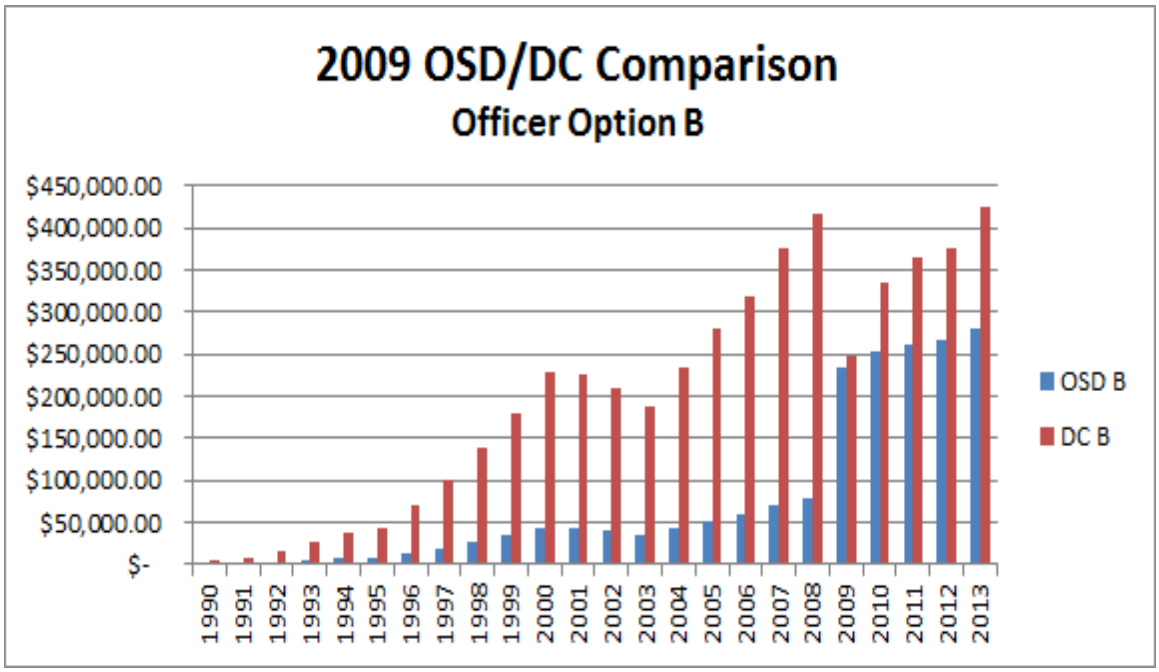

Figure 17. Comparing the Growth of OSD B to DC for 2009 Retirees

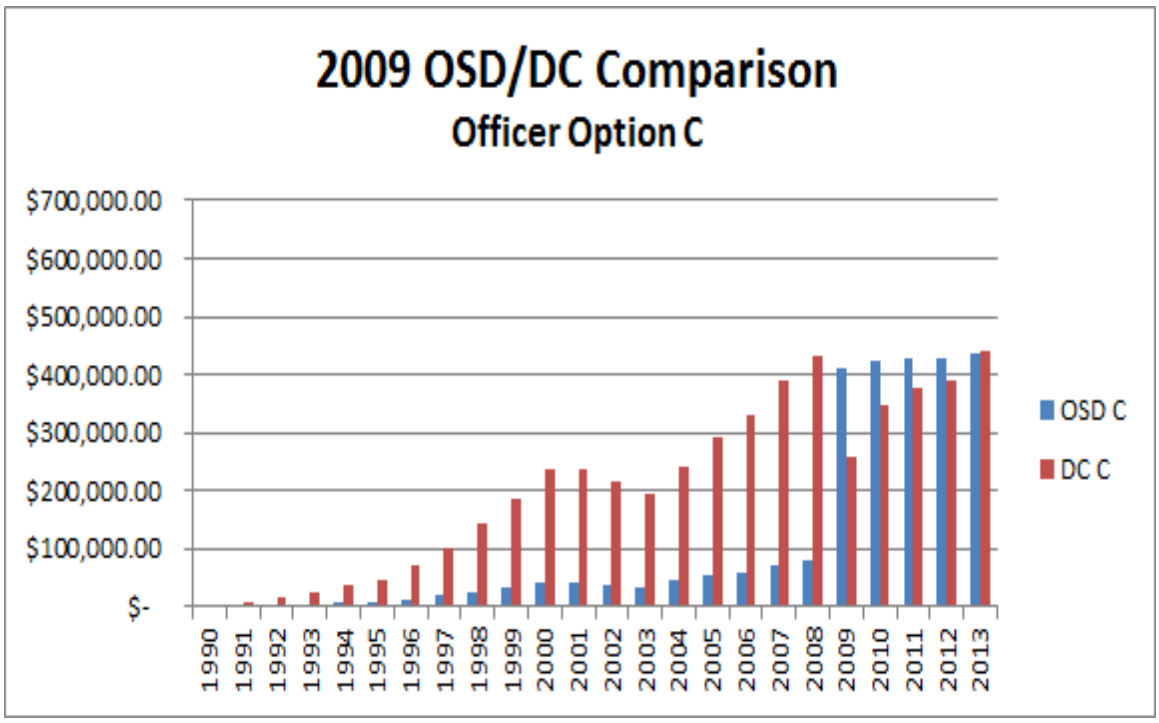

Figure 18. Comparing the Growth of OSD C to DC for 2009 Retirees

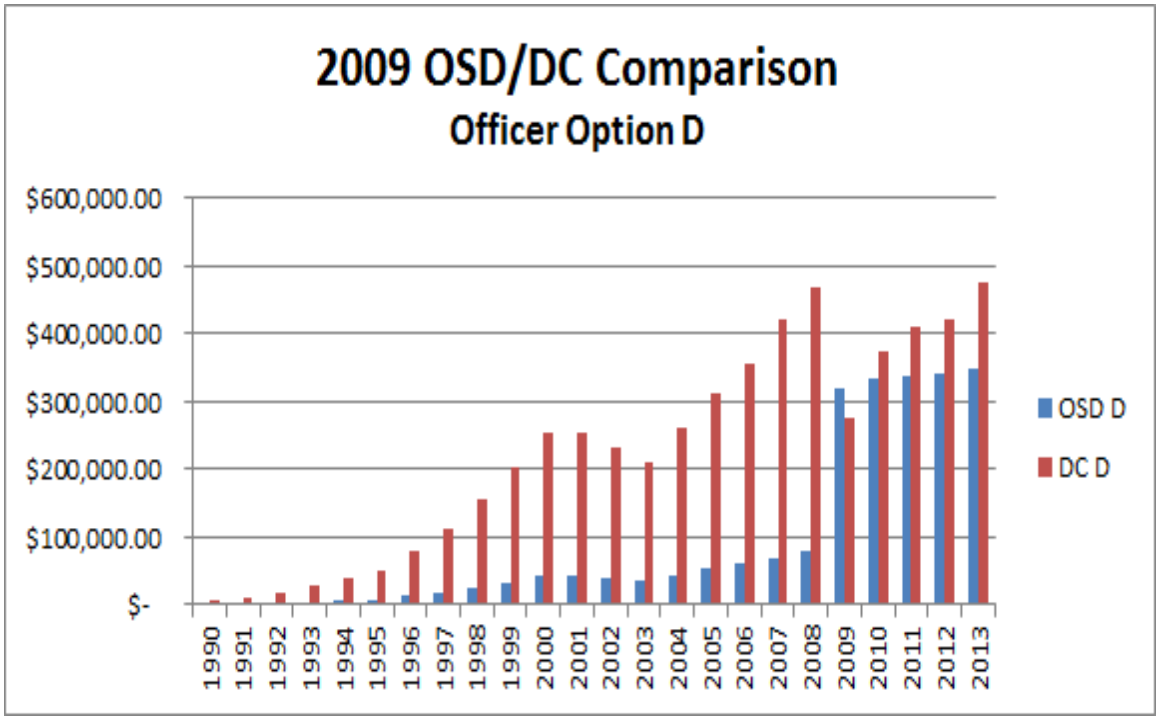

Figure 19. Comparing the Growth of OSD D to DC for 2009 Retirees

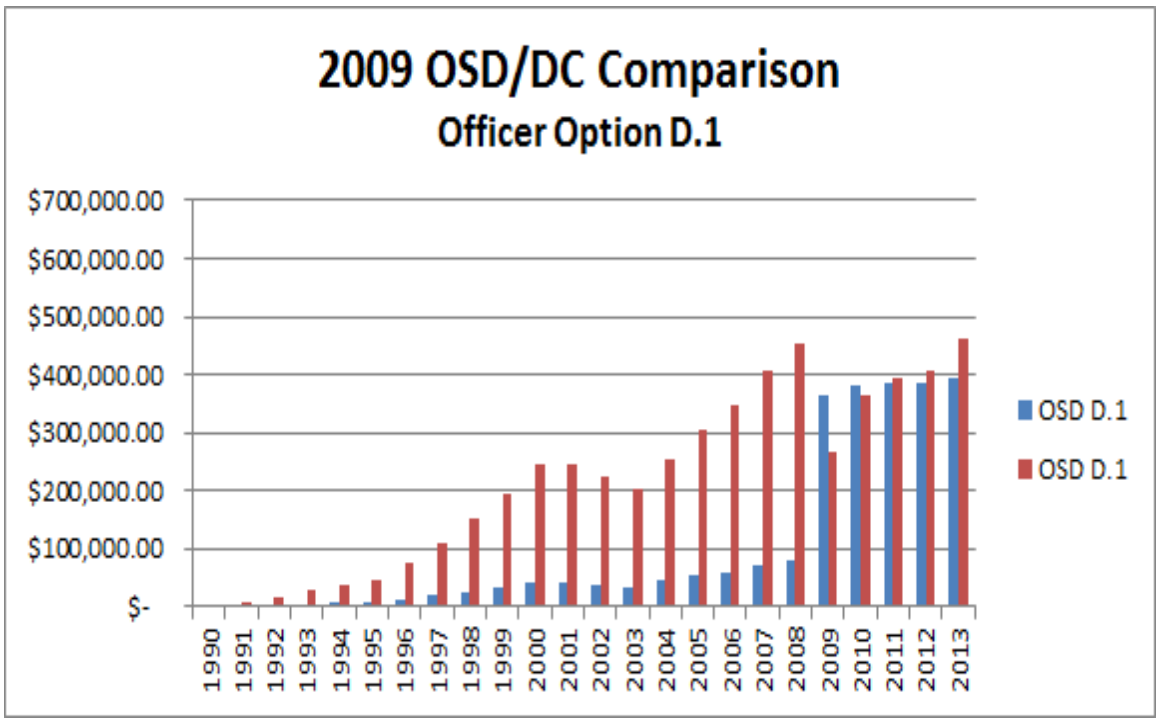

Figure 20. Comparing the Growth of OSD D.1 to DC for 2009 Retirees

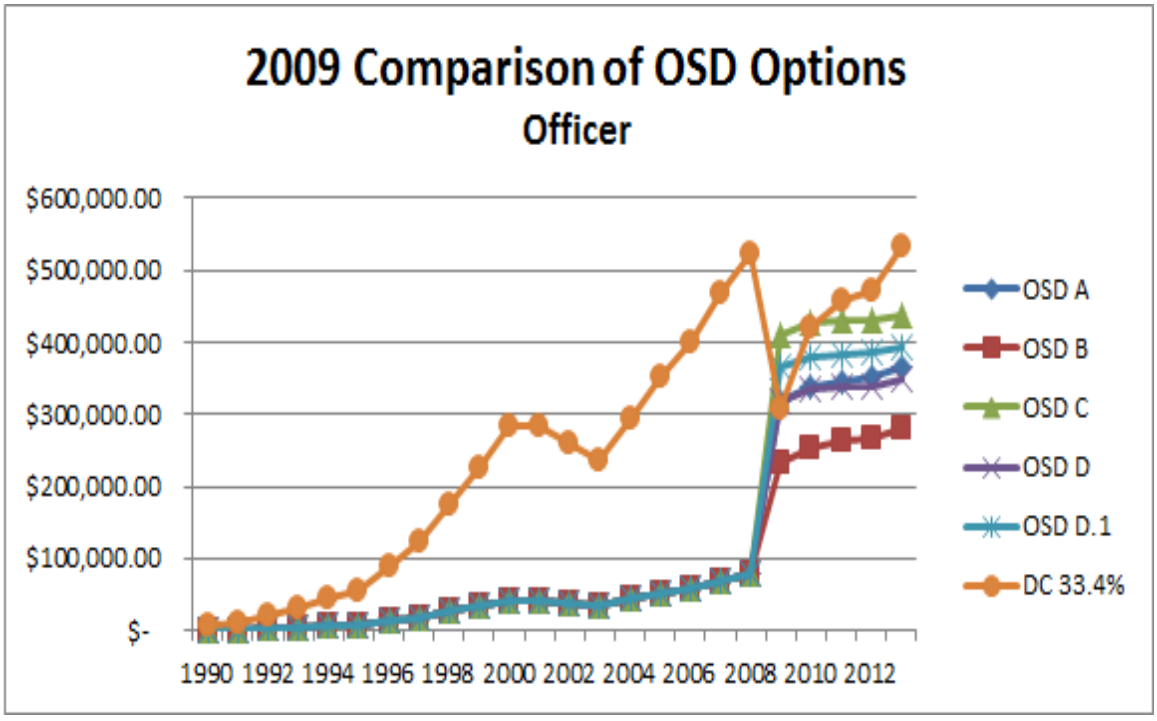

Figure 21. Comparing the Growth of OSD Options to DC funded at 33.4% for 2009 Retirees

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